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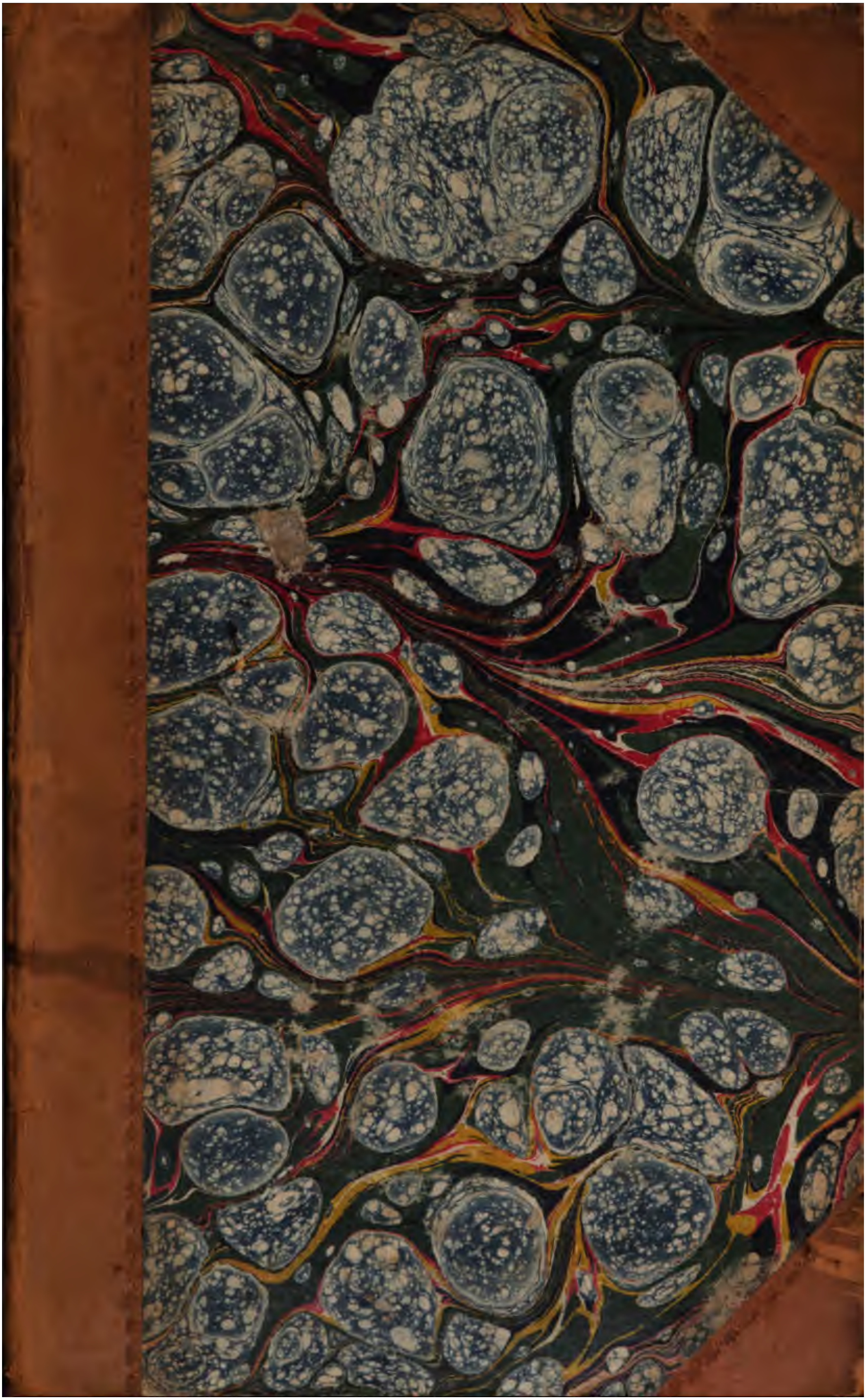

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AN ESSAY ON
THE WAR-GALLEYS OF
THE ANCIENTS.

BY JOHN HOWELL.

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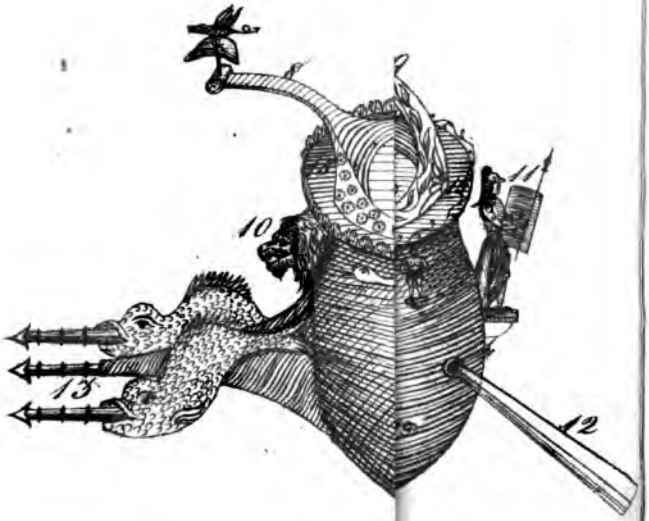

1 Τρόπις. Carina. Calastroma.
2 Κὺτος. Testudo.
3 Πλευραὶ, Latera.
4 Τοῖχοι, Fori, vel Transtra. nna
5 Ἔγκωπα, Foramina remor
6 Πρῶρα. Prora. es qui malum
7 Πρύμνη, Puppis. interdum ot

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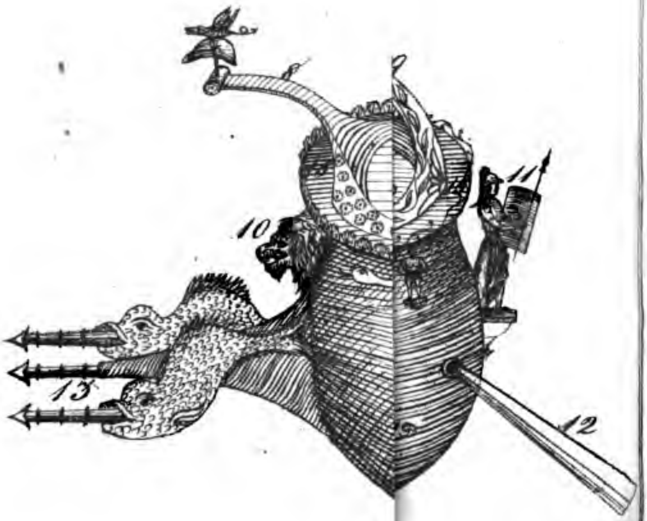
ESSAY

ON THE

GALLEYS OF THE ANCIENTS.

Of all the efforts of human invention, Navigation has been of most importance to man. To it we are indebted for almost all we possess, both of comfort and knowledge; by it the most distant parts of the world are in a manner brought into contact; it transfers the superabundance of the happier climates to the more sterile; it is the instrument of a benign and bountiful Creator for the diffusion of truth; and will ultimately be the means of civilizing the whole human race.

Had navigation been still unknown, the war whoop had yet rung in the wilds of America; the human victim bled in the islands of the Pacific Ocean; even Britain, with all its virtues and knowledge, must have remained the abode of ignorance and barbarism. All, therefore, that can



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Had navigation been still unknown, the war whoop had yet rung in the wilds of America; the human victim bled in the islands of the Pacific Ocean; even Britain, with all its virtues and knowledge, must have remained the abode of ignorance and barbarism. All, therefore, that can in the least elucidate an art to which we are so much indebted, cannot fail to interest every thinking mind.

Interesting as the subject is, however, I shall not attempt to trace its progress from the earliest times down to the present; from the first rude attempts when men adventured themselves upon a few branches bound together, as the Esquimaux of the present day, up to the unique first rate man-of-war of the British Navy. The object of this essay is merely an attempt to clear up a difficulty which has clouded this interesting subject ever since the revival of learning in Europe, relating to the manner in which the ancients constructed their Polycrota or war-vessels. These vessels were in use for about nine hundred years, that is, from the first invention of the Bireme by the Erythræans, the inhabitants of a city in Asia near Chius, about three hundred years after the destruction of Troy, until the battle of Actium, in which Octavius defeated Mark Anthony and Cleopatra, after which period, according to the best Roman authors, they went into disuse. Polybius and Plutarch expressly say, that Augustus ascribed his victory to the superior sailing of the Liburnicæ, or Monocrota, galleys with only one bank of oars.

Since the revival of learning in Europe, few subjects of antiquity have been so often discussed, or investigated with so much labour and research, as the manner in which the ancients constructed their war-vessels, known by the name of *longæ naves* or Galleys. These were classed according to the number of their banks of oars, as ***Biremes, Triremes, Quadriremes, Quinquiremes,*** up to Ptolomy Philopater's ***Tesseraconteres.***

In whatever point of view the subject is taken up, it is surrounded with difficulties; as at present there is no detailed account of any one of these ships known to have escaped the wreck of ancient literature. The measurement of the galley built by Ptolomy Philopater, of *forty banks of oars*, has only served to increase the difficulty, as no gem, or carved representation, or painting of any kind, has been discovered to aid the inquiry. Upon Trajan's column at Rome, vessels are sculptured, conjectured to be those of two and three banks of oars, one above another; but they are so confusedly represented and crowded with figures, that it is evident they could not have been navigated as represented by the artist, which makes their authority of little weight in clearing up the difficulty. The only source that remains from whence any information can be drawn, is the isolated and scanty notices of these vessels which occur in the historian or poet, as the one narrates the naval actions in which they were employed, or the other casually mentions them to embellish his theme.

It may appear presumptuous in me to attempt to solve the difficulties that hang over this subject of antiquity, when so many able men have failed. My excuse must be the deep interest I have felt, and the almost irresistible desire that has occupied my mind, ever since I read the life of Themistocles in Cornelius Nepos at school, to have a clear and satisfactory idea of how the Trireme and larger war-galleys were formed. Though it is now twenty-five years since that time, still I recollect with pleasure the efforts of my young mind searching in a labyrinth of difficulties after their solution. I can safely say this first gave me a taste for mechanics, which has never forsaken me. As I grew up, every author who had treated of my favourite subject I perused with avidity and laid down with disappointment; there was no reconciling their theories to the accounts left us, scanty as they were. Disappointed, but not disheartened, waiting patiently for an opportunity to embody the ideas I had formed of the Galley, and reconcile them to the fixed laws of mechanism by actual experiment, and taking the ancient authors for my only guide, I commenced my task. Cheered by the harmony I discovered between my model and the authors, and its fitness for every purpose they mention, I finished my undertaking with a feeling I cannot express—but it was worthy an age of toil. Of my success the reader will form his own judgment from the following pages.

SECTION I.

OF THE SHIPPING OF THE GREEKS AND ROMANS.

THE ships mentioned by the Greek and Roman authors may be divided into two classes; the first, those of burden, or merchant ships; the second, the galleys or war-vessels. To these some add a third, the ships of passage, distinguished by name according to the occasions they were employed upon, such as ὁλκάδες, φορτηγοὶ and ϖλοῖα, ships of burden, and ϖόρια and ἐπιϐάδες, when carrying unarmed men, and if these were armed ὁπλιταγωγοὶ, and στρατιώτιδες; ships when fitted up to carry horse, were called ἱππηγοὶ, and ἱππαγωγοὶ. As these may, without any difficulty, be placed in the first class, I shall not fatigue the reader by enumerating the names, as it is principally to the second class this essay is meant to refer. It will, however, be necessary to remark, that the *onerariæ naves* of the Romans, and ὁλκάδες of the Greeks, were distinguished, when carrying merchandise, by having a basket upon their mast-head, or some other conspicuous part of the ship, and were principally navigated by sails; or, at other times, when acting as transports, towed by the galleys.

The galleys or war-ships of the ancients, which form the second class, were managed by oars, though sails were not awanting. These may be likewise divided into two classes, the Monocrota with only one range of oars along the gunnel of the ship, and the Polycrota with many banks of oars.

The Monocrota are without doubt the most ancient. There appears from Homer to have been no others in the Greek fleet at the siege of Troy, and that these were without decks of any kind. Thus he describes Ajax defending the Grecian ships against the Trojans,

> —— Νηῶν ἰκρί' ἐπῴχετο μακρὰ βιβάσθων.
>
> "He marched upon the hatches with long strides."
>
> *Iliad.*

Which may indicate his stepping from seat to seat, as ἰκρία νηος, equally means any place of footing in the ship except her bottom. It is rendered hatches by the scholiasts upon Homer. It occurs more explicitly in the Odyssey, where Ulysses is preparing to encounter Scylla :—

> ——εἰς ἰκρία νηὸς ἔβαινε
> Πρώρης——
>
> " Upon the hatches of the prow of the ship he went."

The words are in the plural in both passages. The ἰκρία νηὸς are evidently quite different from the επηγκηνιδες of the ancient Greeks, by the moderns called Καταπατητοι, afterwards in use. Thucydides says expressly, that before the time of Themistocles the Athenians had no covered galleys.* The ἰκρία νηὸς, I humbly conceive to have been the thwarts or seats upon which the rowers sat, which no ship with oars could want. The passage in the description of the ship Argo, where Hercules and Silas are said to have preceded others in eating the spray, *i. e.* enduring the spray, Hyginus in his Mythology has it thus explained, " they being strongest, sat in the bow of the ship," showing that she was without any kind of deck in her bows.

As in all probability the inhabitants of the Ukraine may have continued in nearly the same state of society as regards the arts from the earliest periods until the middle of the seventeenth century, I have taken from Sieur de Beauplan's description of the Ukraine in the years 1645–6, the following extract describing their piratical expeditions upon the Black Sea. It will, I think, give a good idea of the first ships of the Greeks, and the Monocrota in their rude state. The only difference that may be between them is the greater degree of labour that might have been bestowed upon the ancient ships; yet we read in Thucydides, (Polybius, Livius, *et alii*,) that they were often built in a very short space of time; in truth, there is a great resemblance of the ancient manner, as the reader will perceive.

---

* Thucyd. l. i. c. 10. οὐδ' αὖ τὰ πλοῖα κατάφρακτα ἔχοντας. " Nor had they as yet covered ships, *i. e.* that is decked." Καταφρακτα is here evidently used in a different sense from Καταστρωματος in the following passage :—(Thucyd. l. i. c. 49,) ἐπειδὴ γὰρ προσβάλλοιεν ἀλλήλοις, οὐ ῥᾳδίως ἀπελύοντο, ὑπό τε τοῦ πλήθους καὶ ὄχλου τῶν νεῶν· καὶ μᾶλλόν τι πιστεύοντες τοῖς ἐπὶ τοῦ καταστρώματος. " When they began to engage with one another, they could not be easily pulled asunder, both on account of the multitude of ships, and also because they chiefly trusted in the soldiers upon the catastromata for obtaining the victory." See likewise Thucyd. l. i. c. 14, l. ii. c. 90, l. vii. c. 70, and many other passages.

" When they intend to go to sea, they march to their place of rendezvous, and there build boats about sixty feet long, ten or twelve feet wide, and twelve feet deep. Their boats have no keel, but are built upon bottoms made of the wood of the willow, about forty-five feet in length, and raised with planks ten or twelve feet long, and about one foot broad, which they pin or nail one over another, like the common boats upon rivers, till they come to twelve feet in height, and sixty in length, stretching out in length and breadth the higher they go. This will be better understood by the rough draught annexed. You may observe

Plate 1.

Fig. 2.

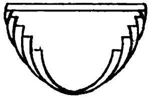
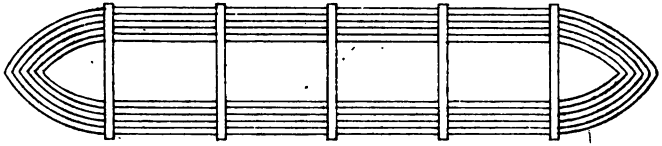


Fig. 2.



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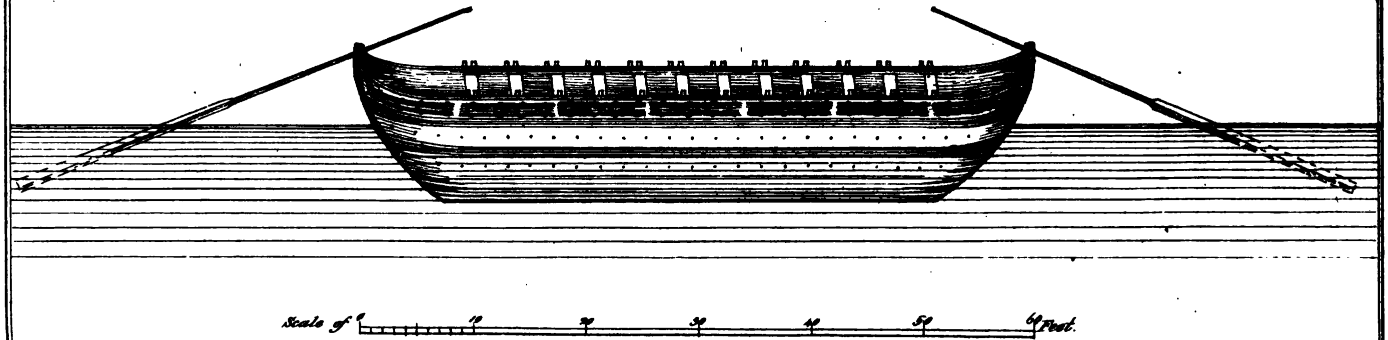

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they have great bundles of large reeds put together, as thick as a barrel, end to end, and reaching the whole length of the vessel, well bound with bands made of lime or cherry tree; they build them as our carpenters do, with ribs and cross-pieces, and then pitch them, *and have two rudders*, one at each end, as appears in the draught, because, the boats being so very long, they should lose much time in going about, when they are forced to fly back. They have commonly ten or fifteen oars of a side, and row faster than the Turkish Galleys; they have also one mast, which carries an ill-shaped sail, made use of only in fair weather, for they had rather row when it blows hard. These vessels have no deck, and when they are full of water, the reeds above-mentioned, tied quite round the boat, keep it from sinking. Five or six thousand Cossacks, all good able men, well armed, take the field, and repair to Zaporouy to build their boats. Sixty of them go about one boat, and finish it in a fortnight; thus, in three weeks time, they make ready eighty or an hundred boats, such as I have described above. Between fifty and seventy men go aboard each vessel. In these vessels, they cross the whole Black Sea, even to Anatolia, which they reach in thirty-six or forty hours from their leaving the Boristhenes."

According to Pliny, the Erythræans were the first who departed from the ancient manner of arrangement, and constructed a Bireme. Herodotus, Thucydides, and Diodorus the Sicilian, agree that Ameinocles, a Corinthian, about three hundred years after the destruction of Troy, first built a Trireme. Clement of Alexandria * gives the honour of this invention to the Sidonians; Aristotle,† a Corinthian, added a fourth rank to the galley. There is a difference as to who first constructed the Quinquireme. According to Pliny, Nesicthon of Salamis has this honour, but Diodorus gives it to Dionysius the Sicilian ; Xenagoras the Syracusan added a sixth ; ‡ Nesigiton built one of ten ; Alexander the Great increased the number to twelve ; Ptolomy Soter to fifteen ; § Philip, father of Persius, had one galley of sixteen ranks ; || Ptolomy Philopater built one even of forty ranks of oars. ¶ This is by far the largest mentioned by any author, and was 280 cubits long, or 420 feet.

According to my views of the subject, it will appear that after Ameinocles** built his Trireme

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* Stromat. Lib. i. † Plinius. ‡ Ibid.

§ Philostephanes. || Polybius in Frag. et Livius.

¶ Athenæus.

** Thucyd. l. i. c. 13. πρῶτοι δὲ Κορίνθιοι λέγονται ἐγγύτατα τοῦ νῦν τρόπου μεταχειρίσαι τὰ περὶ τὰς ναῦς, καὶ τριήρεις ἐν Κορίνθῳ πρῶτον τῆς Ἑλλάδος ἐνναυπηγηθῆναι· φαίνεται δὲ καὶ Σαμίοις Ἀμεινοκλῆς Κορίνθιος ναυπηγὸς ναῦς ποιήσας τέσσαρας. "And the Corinthians first are reported to have changed the form of the ships, which comes nearly to that which is now in use, and the Corinthians are reported, first of all Greece, to all difficulty was removed as to the construction of the larger classes, save the additional materials and workmanship, and it only remained a question of utility against expence, what number of ranks should be given to the galley. That the expence was enormous, we may learn from one of the orations of Demosthenes, who says that the lighter vessels could not be kept in a fit state for service with great economy, under a sum equal to about £ 8000 annually of our money, and no great damage befalling them, or the expence was proportionably increased. We may thus form some idea of the riches of a state, by the size and number of their galleys.

The same reasons, I have no doubt, would weigh with the ancient governments as with the modern in the construction of their war-vessels; we find that ships of 100 guns and upwards are very seldom built, their utility being found not to compensate the expence of building, with the tear and wear afterwards. Ships of from sixty to eighty guns are in greatest estimation. The Greeks during the Peloponnesian war used few galleys larger than Triremes. * The Romans during the republic principally used the Quinquireme; the Carthaginians, did the same, yet the Hexireme and Septireme

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have Triremes; it is certain also that Ameinocles, the Corinthian, a ship-builder, made four ships to the Samians."

* Xenoph. et Thucyd.

often occur.* Though the Ptolomies of Egypt and Asiatic Greeks built galleys of very large size, yet we read the Romans found no difficulty, proportioned to their bulk, in capturing them with their smaller ships, from the superior bravery of the men in naval actions; their chief aim being to get alongside of the enemy, and reduce the contest as near as possible to their mode of fighting on shore.

From the difficulty of explaining the ancient manner of arranging the oars, most of the moderns who have treated of the subject boldly assert that vessels of more than five ranks of oars were built solely for show.† That this was not the case, however, is evident from the whole tenor of history. In the first naval action of the Romans with the Carthaginians, Duilius the consul fought in a Hexireme, and took Hannibal's Septireme.‡ During the Peloponnesian war, however, the Greeks used the Trireme, for the obvious advantage they enjoyed in being easily drawn on shore into their naval camp when the enemy appeared superior to them in force.§ This they could not have done with the same facility had their galleys been of a larger size; and on more than one occasion they transported their fleets across the Isthmus of Leucadia. *

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* Livius et Polybius. † Vossius and many others.

‡ Polyb. l. i. c. 23. ἡγεῖτο δ' Ἀννίβας αὐτῶν οὗτος δ' ἦν ὁ τὰς δυνάμεις ἐκκλέψας νυκτὸς ἐκ τῆς τῶν Ἀκραγαντίνων πόλεως. ἔχων ἑπτήρη, τὴν γενομένην Πύῤῥου τοῦ Βασιλέως. "And Hannibal was general of the fleet; who, by night, in stealth, led away the forces from the town; he sailed then in a septireme, which once upon a time belonged to King Pyrrhus.

§ Thucydides et Xenoph.

Plutarch in his life of Demetrius Policraetes gives an exact, and indeed surprising account of his galleys, and solemnly asserts he does not exaggerate. Demetrius, a prince possessing great knowledge in the arts, and of an inventive turn of mind, having bent the whole force of his genius to the improvement of his galleys, caused several of fifteen and sixteen benches to be built, he himself superintending the whole details. These he used with the greatest advantage in his battles and sieges, so much so, that Lysimachus, while besieging Rhodes, could not believe what common report said of them. He therefore sent a request to Demetrius, begging him to allow his galleys to be rowed in his presence This request, although that of an enemy, Demetrius granted. These ships were so elegantly constructed, so richly ornamented, so swift in their motions, and, at the same time, of so vast a size, Lysimachus could hardly believe the reality of the scene. The consequence was, he raised the siege of the city solely from the dread

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* Thucyd. l. 4. c. 8. βοηθεῖν ὅτι τάχιστα ἐπὶ Πύλον. καὶ ἐπὶ τὰς ἐν τῇ Κερκύρᾳ ναῦς σφῶν τὰς ἑξήκοντα ἔπεμψαν, αἳ ὑπερενεχθεῖσαι τὸν Λευκαδίων ἰσθμὸν, καὶ λαθοῦσαι τὰς ἐν Ζακύνθῳ. "That they might bring the earliest help to Pylos, they sent a messenger to their sixty ships which were at Corcyra, which being transported over the Leucadian Isthmus to evade the Attic fleet which lay at Zacynthus."

he had of these galleys of fifteen and sixteen banks. Plutarch likewise, in his life of Anthony, says he had a fleet of 500 sail of armed vessels magnificently adorned and furnished with eight and ten banks of oars. Preparatory to the battle of Actium he selected the best and largest ships from three banks of oars up to ten; thus making it evident that galleys of more than five ranks were by the ancients built for war as well as show.

That Ptolomy Philopater built the Tesseraconteres, which Athenæus, (lib. v. chap. 37,) describes as having forty banks of oars, and Hiero of Syracuse, his galley of twenty banks which had gardens and baths more resembling a palace than a ship, out of a vain pomp to display their riches, is evident from the style in which they were decorated. For a particular description of these ships, see Athenæus. To give some faint idea of the bulk of this last, it may be mentioned that she was sent as a gift to Ptolomy, none of the ports of Syracuse being deep enough to admit her. There being a scarcity of corn in Egypt at the time, she had on board 600,000 medimni of corn, equal to 720,000 bushels of English measure, each medimnos being four pecks and six pints; 10,000 dolia of salt meat; 20,000 talents of wool and many other gifts.

Of all the ancient nations, the Asiatic Greeks and Egyptians are recorded to have built the largest vessels. A Greek colony on the Black Sea, furnished Xenophon with Triremes when he retreated into Asia Minor, to transport his army into Greece.* The Heracleans became so powerful and well skilled in naval affairs, that their alliance was courted by all the Asiatic princes. When Ptolomy and Antigonus were at war, they sent to the assistance of the former a numerous fleet, well equipped and manned. Some of these ships were of very large dimensions.

It is scarcely necessary to multiply quotations with the view of proving the untenableness of the opinion, that all galleys of more than five banks of oars were built only for show, since all history is at variance with it. Nor would I have gone so far as I have done, solely to demonstrate the fallacy of that opinion. But the subject is otherwise interesting, as showing to what wealth and prosperity the ancient maritime states had arrived, prior to their being totally swallowed up in the Roman Empire. Their wealth they owed to their navigation and commerce. The Romans were a warlike, not a commercial people; the success of their arms swept the wealth of their less powerful neighbours to the capitol, where it ceased to accumulate, and was gradually dissipated among her more commercial provinces, until wrung from them again by her exactions.

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* Xenophon. Exped. v. c. 9.

It only remains to conclude this section with a description of the Monocrota in their most finished state, such as I conceive the Liburniæ to have been when they superseded the Polycrota after the battle of Actium, from which time they went gradually out of use, Augustus attributing his victory to their superior speed in sailing;* a property they could not fail to possess over the more lofty built Polycrota. Their height causing them to sink more deeply into the water, rendered them so much the more heavy to pull. Likewise we learn from Cæsar and others, a new mode of acquiring height for their troops had been lately introduced, that of building lofty towers upon the decks of the galleys, a thing they could hardly admit of, and the Liburnicae were better adapted for. These, I think, were the reasons for their being set aside. I select one from Cæsar. There are many others in his Commentaries, and other ancient authors. Lib. iii. passage xiv. in describing his preparations to encounter the ships of the Veneti, he says, " Turribus autem excitatis, tamen has altitudo puppium, ex barbaris navibus superabat; ut neque ex inferiore loco satis commodæ tela adjici possent, et missa a Gallis gravius acciderent."—"But when the towers had been built, the height, however, of the poops of the ships of the barbarians overtopped them, so that weapons could not with any effect be discharged against them from a lower position, and the weapons discharged by the Gauls fell with greater effect upon our men." A curious passage in Plutarch's life of Alcibiades, shows what the Triremes were during the Peloponnesian war, and the wretched accommodation on board of them. One of the charges against Alcibiades was effeminacy, and as a proof of this, he caused the deck of his galley to be sawn up, and his bed slung on girths;—thus he was the first who used a hammock.

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* Plutarch, Polybius.

That they were copied one from another, down to the present time, is highly probable. After the destruction of the western empire, the eastern continued their use unimpaired; the Venetians, Genoese, and French at Marseilles, using the same galleys, with very little alteration. A description of these will be of great use in this place, as it will, in many points, aid the illustration of the Polycrota; and the reader will at once remember many passages he has read wherein they coincide. The passages are copied from the Memoirs of a French Protestant, condemned to the galleys in the year 1701. 2 vols. 12mo. Vol. I. p. 105.

"A Galley is ordinarily 150 feet long, and 50 broad; it consists but of one deck, which covers the hold; this hold is, in the middle, seven feet, but, at the sides of the Galley, only six feet high. By this we may see that the deck rises about a foot in the middle, and slopes towards the edges to let the water more easily run off; for, when a galley is loaded, it seems to swim under water, at least the sea constantly washes the deck. The sea would then necessarily enter the hold by the apertures, where the masts are placed, were it not prevented by what is called the coursier. This is a long case of boards fixed on the middle or highest part of the deck, and running from one end of the galley to the other. There is also an hatchway into the hold, as high as the coursier. From this superficial description, perhaps it may be imagined, that the slaves, and the rest of the crew, have their feet always in water. But the case is otherwise; to each bench there is a board raised a foot from the deck, which serves as a footstool to the rowers, under which the water passes. For the soldiers and marines, there is running on each side along the gunnel of the vessel what is called the bande,* which is a bench of about the same height with the coursier, and two feet broad. They never lie here, but each leans on his own particular bundle of clothes in a very incommodious posture. The officers themselves are not better accommodated, for the chambers in the hold are designed only to hold provisions and naval stores of the galley.

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* By the Greeks called *catastroma*, and is here put to the same use as Thucydides mentions.

"The hold is divided into six apartments.

"1. The Gavon, a little chamber in the poop, only large enough to hold the captain's bed.

"2. The Escandolat, where the captain's provisions are kept and dressed.

"3. The Campagne, where their water, beer, and salt meat, &c. are kept.

"4. The Paillat, where the dried provisions are kept.

"5. The Tavern; this is in the middle of the galley. Here wine is sold by the Comite. This opens into the powder-room, of which the gunner alone keeps the key; in this chamber also the sails and tents are kept.

"6. The steerage, where the cordage and the surgeon's chest are kept, serves also during a voyage as an hospital for the sick and wounded.

"A galley has fifty benches for rowers, that is to say, twenty-five on each side. Each bench is ten feet long; one end fixed in the coursier, the other in the bande half a foot thick, and placed at four feet distance from each other. They are covered with sackcloth stuffed with flocks, and over this is thrown a cow-hide, which, reaching down to the banquet, or footstool, gives them the resemblance of large trunks. To these the slaves are chained, six to a bench; along the bande runs a large rim of timber about a foot thick, which forms the gunnel of the galley. To this, which is called the apostic, the oars are fixed. These are fifty feet long, and are poised in equilibrio upon the afore-mentioned piece of timber, so that the thirteen feet of oar which come into the galley, is equal in weight to the thirty-seven, which go into the water. As it would be impossible to hold them in the hand, because of their thickness, they have handles, by which they are managed by the slaves.

"*The Method of Rowing a Galley.*

"The Comite, who is master of the crew of slaves, and the tyrant so much dreaded by the wretches fated to this misery, stands always at the stern, near the captain, to receive his orders. There are two sous-comites also, one in the middle, the other near the prow. These, each with a whip of cords, which they exercise without mercy on the naked bodies of the slaves, are always attentive to the orders of the comite. When the captain gives the word for rowing, the comite gives the signal with a silver whistle, which hangs from his neck; this is repeated by the sous-comites, upon which the slaves, who have their oars in readiness, strike all at once; and beat time so exactly, that the whole fifty oars seem to give but one blow. Thus they continue, without requiring fresh orders, till, by another signal of the whistle, they desist all in a moment. There is an absolute necessity for this rowing altogether, for, should one of the oars be lifted up, or fall too soon, those before leaning back necessarily strike the oar behind them with the hinder part of their head; while the slaves of this do the same by those behind them. The labour of a galley-slave is become a proverb; nor is it without reason that this may be reckoned the greatest fatigue that can be inflicted on wretchedness. Imagine six men chained to their seats, naked as when born, sitting with one foot on a block of timber, fixed to the footstool or stretcher; the other lifted up against the bench before them, holding in their hands an oar of an enormous size. Imagine them lengthening their bodies, their arms stretched out to push the oar over the backs of those before them, who are also themselves in a similar attitude. Having thus advanced their oar, they raise that end which they hold in their hands, to plunge the opposite in the sea; which done, they throw themselves back upon their benches below, which are somewhat hollowed to receive them. No free man could continue at the oar an hour unwearied; yet a slave must sometimes lengthen out his toil for ten, twelve, nay, for twenty hours without the smallest intermission. On these occasions, the comite, or some of the other mariners, put into the mouths of those wretches a bit of bread steeped in wine, to prevent fainting through excess of fatigue or hunger, while their hands are employed upon the oar; at this time, the captain roars to the comite to redouble his blows; and when any one drops from his oar in a swoon, which frequently happens, he is whipped while any remains of life appear, and then thrown into the sea without further ceremony." [It is incredible what numbers of Protestants perished in this manner, during the reign of Louis XIV.]

Vol. I. p. 179. "The reader has been told that there are six slaves to every oar; the most vigorous of which is always placed at the end of the oar, as being the most laborious station, the strongest then compose the first class, and have the greatest fatigue; those of the second class sit next them, and share the next degree of labour; and so of the rest till it comes to the sixth. Those last have scarce any fatigue, and consequently are always composed of the most feeble."

This way of classing the slaves renders that passage in Thucydides quite clear, where he says, the Thranites, or rowers of the first class, had larger pay than the Zugites and Thalamites. Le Roy, and all who have written before him on this subject, have explained this by saying the Thranites pulling the longest oars were placed in the highest benches; consequently, they had more fatigue, and were more exposed to the darts of the enemy.* That the labour of the rowers was equal whether they were placed at the highest or lowest oar is evident; for we read that the oars were equipoised on the scalmi, and the impulse must have been given by the weight of the rower's body thrown backwards upon the seat. The largest oars in the Galley of forty banks, mentioned by Athenæus,† had lead in their handles to balance the outer part. The fatigue, as described above, was in stretching the body, which was caused by the elevation of the end of the oar. Thus the oars could not have been heavier to the highest bench of rowers than they were to the lowest, as there was not a difference of more than five feet between the longest and shortest oar, as will be shown in its proper place. It is clearly evident, that, when a lever is balanced upon a centre, one ounce will make either end preponderate, whatever the length of the lever be. If this be allowed, the Thranites were the rowers who pulled at the end of the oar, the Zugites pulled in the middle, and the Thalamites next the ship's side. This will be better understood when we come to speak of the Polycrota.

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* Thucyd. l. vi. c. 31. καὶ ὑπηρεσίας ταύταις τὰς κρατίστας τῶν τριηράρχων, ἐπιφοράς τε, πρὸς τῷ ἐκ δημοσίου μισθῷ, διδόντων τοῖς θρανίταις· "and the Trierarchs gave most excellent servants to them, and besides their public pay, also an extraordinary one out of their own private fortune to those sailors who were called Thranites."

† Athenæus, lib. v. chap. 37.

The ancients had sometimes, it is said, galleys of one bank of immense size. Suetonius mentions the Liburnian Galley, built by Caligula. He calls her δίκηρη because she had ten men on each oar; she had eighty oars on a side, and one thousand six hundred rowers. Pliny likewise mentions the Liburniae of Caius, which had forty oars on a side, and five rowers to each oar. The following passage from Virgil, Æn. book v. line 120, is rather difficult to explain;

> ———" Triplici pubes quam Dardana versu
> Impellunt, terno consurgunt ordine remi;

"Which the Trojan youths impel by triple turns (or rows,) three orders of oars (rowers) arise."

It is quoted as a proof of their being Triremes. I think it cannot bear this construction. Virgil was too well-informed not to know that Triremes were not invented until about three hundred years after the time of which he writes. He appears to have put the rower for the oar, a thing not uncommon with the ancients, as is evident from many passages. Both among the Greek and Latin authors, the oar is often metaphorically put both for the rower and for the ship, and for navigation itself. Thus, Cicero against Verres, when he says that the Syracusans had cast a multitude of pirates from the ship, which was made with the number of six oars,—this passage cannot be otherwise understood than as a ship of six ranks of oars, having six men at each oar, the pirate being a Hexireme. This will be shown afterwards to tally completely with the crews of such vessels, as they are mentioned by the ancient authors. A multitude of men could not be contained in a ship navigated with only six oars, neither would pirates have attempted enterprises in such small vessels, nor would they have been so formidable as they are represented in ancient authors. That their ships were large and well-manned, is clearly shown from the honour Pompey acquired, though aided by 500 ships and 120,000 men in destroying them, and taking or sinking 1000 of their ships. They fought a regular engagement with his fleet off the coast of Cilicia.*

The meaning of Virgil, in the passage, seems to be, that she was full manned, having the three orders of rowers, Thranites, Zugites, and Thalamites.

That the Monocrota had more than one rower upon each oar, there can be no doubt, as the evidence is decisive, both from ancient authors and modern practice. I have been more particular upon this point than the reader may think necessary, yet am compelled to be so, to shorten the discussion when I come to speak of the Polycrota, many of the authors who have treated of them, allowing only one rower to each oar, whatever number of banks she had. The learned General Melvill is of this opinion, while Vossius and Le Roy, allowing only one man to each oar in a Trireme, increase the number in the galleys of a larger class. Le Roy even assumes that not less than twelve men were employed upon the highest oar in the Tesseraconteres of Ptolomy.

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* Plutarch et Livius.

SECTION II.

CONSTRUCTION OF THE POLYCROTA, OR WAR-GALLEYS WITH BANKS OF OARS.

Before proceeding to lay before the reader the opinion I have been led to form regarding the structure of the war-vessels of the ancients, it will be necessary for me to give a brief account of the previous theories that have been formed on this subject, and the objections to which they are liable in a mechanical point of view.

The first idea that arises in the mind of almost all readers upon their first perusal of the ancient authors is, that the different banks of oars in the war-galleys were placed one above another. Untenable as this theory is, when the difficulties attending it are taken into consideration, it has not wanted supporters of great learning and merit. Morisotus, in his Orbis Maritimus, page 608,* holds this opinion, and quotes a passage from the Emperor Leo, which he thinks conclusive. The words are, "Every ship of war must be of its due length, having two ranks of oars, the one higher, the other lower." Those who hold a contrary opinion count this quotation of no force, and far from setting the question at rest, as the author supposes. Even though it were allowed as to vessels of two banks, it leaves us, regarding the larger classes, as much in the dark as ever. The only point that appears strong in his argument is his reference to the sculpture on the column of Trajan at Rome. There the ranges are conceived to be placed one over the other; but, as I before mentioned, the representations are so confused as to give no satisfactory information on the subject, which any person, not influenced by a preconceived opinion, will at once perceive upon an examination of the plates that have been published of this ancient monument. Several paintings of ancient vessels have also been discovered in the ruins of Herculaneum, but so much effaced, that nothing can be gathered from them* to throw any light upon the subject. And it may be observed, further, that the passages in the ancient authors cannot be explained by this theory, either as to the required number of men or oars, leaving out of view altogether its utter incompatibility with the fixed laws of matter and motion. This will appear more clearly

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* Morisot. Orb. Mar. 608. See likewise Scheffer de Militiâ Navali Veterum.

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* Mitford's Greece, vol. ii. p. 195.

Plate II.

Fig. 3

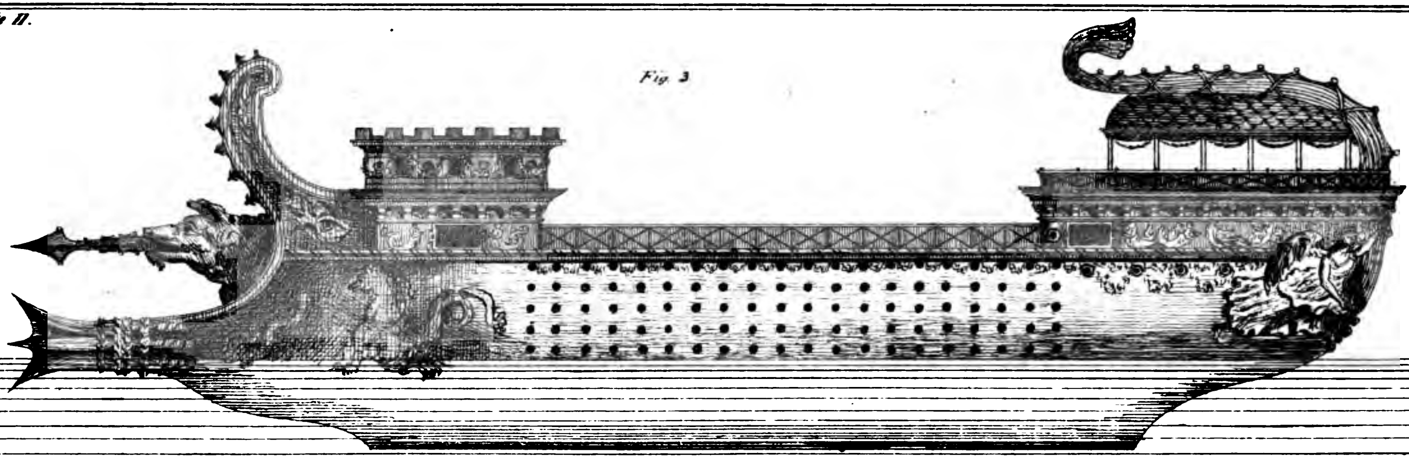
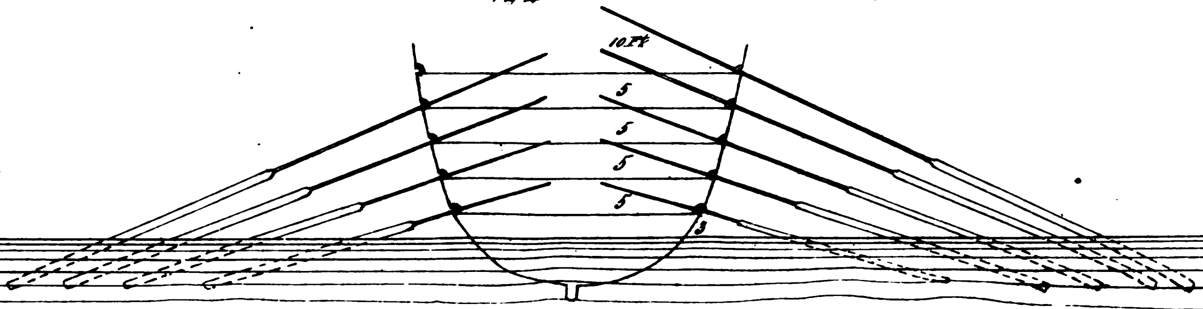


Fig. 4



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from the annexed plate of a Quinquireme, according to this theory. (See Figs. 3 and 4.)

The height of the first row of scalmi from the water cannot be less than three feet, and between the decks, five feet is the least that can be allowed for the men to row in. Thus, even were it possible to place the oars, which it is not, the scalmi of the upper oars would be twenty-eight feet from the water. But it is plainly demonstrated in the annexed section, that the decks must be progressively higher after the first rank, or the oars lengthened beyond all possibility of being wrought by human power; and every additional bank would add to the difficulty in an increased ratio. That Hexiremes were efficient ships, and not built for show, Duilius proved. * I shall not therefore urge my opinions on this subject further, but refer to the plate; an examination of which will enable the reader to weigh the merits of this theory, and judge for himself.

The second solution that has been proposed, is, that the different banks of oars were ranged, not one above another, but in one continuous line along the side of the galley; the first in her bows, the second in her waist, the third in her stern, when a Trireme; and, if of a greater rank, the different banks were still added on the same line from prow to poop, with intervals between. This

* Polybius, b. i. cap. 23.

opinion has many supporters of great learning and merit. Though maintained by Stewechius and Castilionius, it is not more tenable than the last, and the faint representations left upon Trajan's column are directly contrary to this hypothesis. It is not necessary here to quote the numerous passages in almost every author, which occur at variance with this theory, and not to be reconciled to it. One objection I shall only state, which I think sufficient for its refutation, as I mean this not so much a dissertation upon the ancient authors as an essay upon the galleys themselves.

In building a galley after this manner, the loss of power is great, and needlessly thrown away by breaking up the continuous range of oars that otherwise would have been obtained along the sides of the vessel, to gain no apparent advantage; and that it never could have been adopted as an improvement on the war-vessels in use, from the times of Homer, by Aneimocles, or any other mechanic, is evident from the annexed plate. (See Fig. 5.)

No doubt the difficulty as to height and length of oar are, by this means, got rid of, but the sacrifice of space and power is too evident not to be perceived; and this arrangement is accordingly not supported by the monuments of antiquity, nor a consistent interpretation of those au-

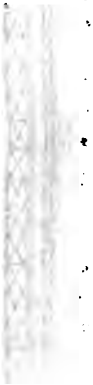

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Plate III.

Fig. 5.

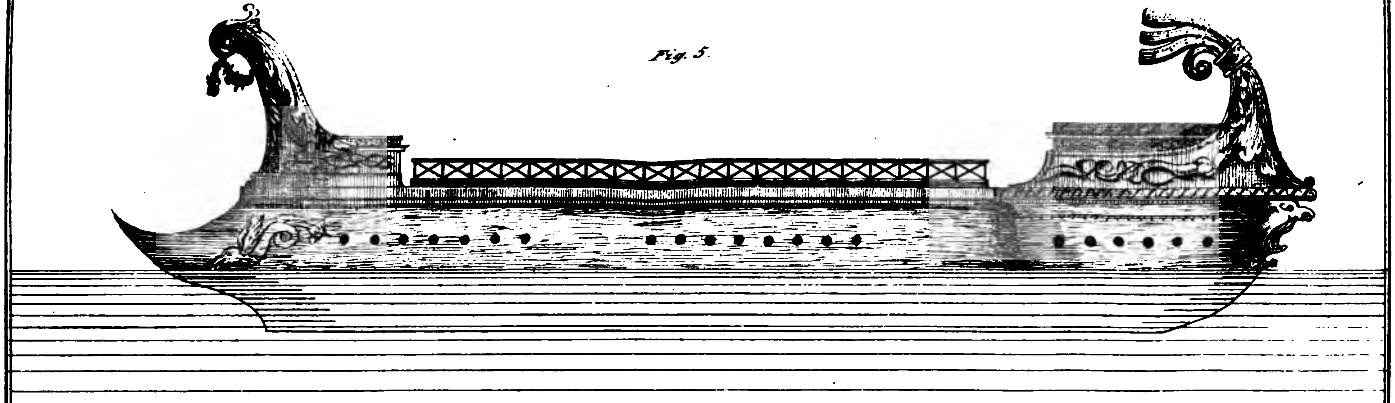
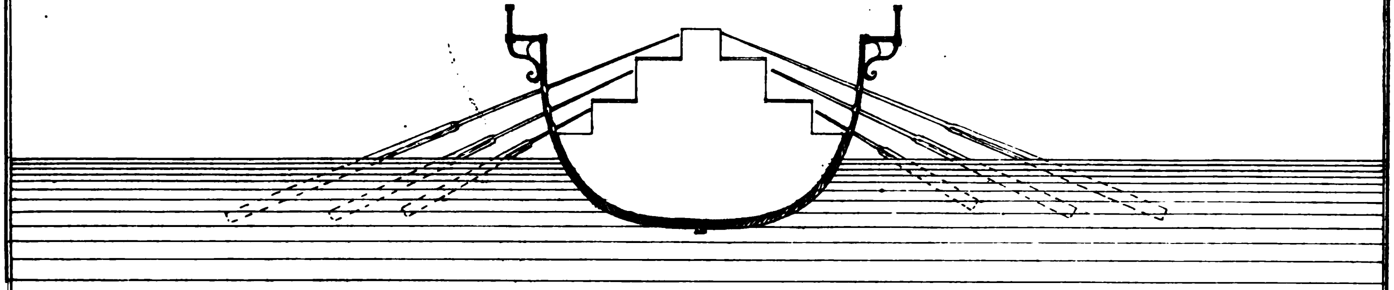


Fig. 6.



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thors who make any mention of the galley. Finally, were a galley to be constructed of ten banks, and there were many of a greater number, their length must have been enormous, far exceeding what Athenæus ascribes to the Tesseraconteres of Ptolomy.* Her length, he says expressly, was 280 cubits, or 420 feet. Now, she had forty banks of oars, and her longest oar was thirty-eight cubits, or fifty-seven feet. A less distance than four feet cannot be allowed between each rower's seat for oars of this length, as one-third of the oar must be within the scalmi at least, to pull with any effect. Thus, four times forty is 160, for forty oars, leaving 260 feet, a part of which would be consumed in the curvature of her stem and stern; she could not have had three oars in a bank, as three times forty is 120, the distance of four feet between is four times 120, or 480 feet, *i. e.* 60 feet more than her length, so that she could only be, were this opinion correct, a galley with one bench of oars. Besides this, we are told she had longer and shorter oars, and these would evidently be quite unnecessary in a galley of this construction. (See Fig. 5.)

A third manner of arrangement has been offered by Sir Henry Savile, † who supposes that the oars were not placed one above another in a straight line, neither in a line from stem to stern, but were arranged in an oblique manner from the sides of the galley to her middle, as is represented in Fig. 6.

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* Athenæus, lib. v.

† A view of certain Military matters, or Commentaries concerning Roman Warfare—1596.

The difficulty of adopting this theory is evident at a single glance; for it would require the galleys to be built of a breadth quite incompetent with their title, *naves longæ,* even were it possible to place the rowers to work efficiently, which it is not. The men who pull the third oar being at such a distance from the scalmi, the range of their oars must be proportionably shortened, or the oar increased in length beyond being easily managed. In raising the height of the galley, it has all the disadvantages of the first theory, and is inferior to the second in reference to its mechanical application to useful purposes.

The fourth hypothesis, which has obtained more general acceptance than any of the preceding, is mentioned with respect by Isaac Vossius in his treatise on the Liburniæ and Triremes of the ancients,* and by Meibomus in his treatise.† It is, that a *Trireme* received its name from *three men pulling at the same oar.* The *Quinquiremes* from *five,* and so on. What part of this theory Rivius, Vossius, Le Roy, and others have adopted, will be seen in the sequel.

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* Thesaurus Antiq. de Rom. Gron. tom. xii. p. 710.

† Ibid.

That this hypothesis is not consonant to the accounts left us by the ancient writers, is evident from what has been already said. Indeed the same arguments apply to this that apply to the second theory. I need not urge that all the ancient authors, who record naval affairs, particularly distinguish between the *Monocrota* and *Polycrota*, when they occur in their narrative.* Now, those who hold this opinion must maintain against the best of evidence, that none but vessels of one bank of oars were in use among the ancients, and that their only distinction was the number of men who pulled at one oar. This opinion, it is conceived, no ingenuity can support, even were it not, like the three preceding, liable to one or two fatal objections.

In the first place, to obviate one objection, the difficulty of placing forty men on each side of the ship in a vessel of forty banks of oars, such as Ptolomy's Tesseraconteres, or even sixteen, as in those of Demetrius Policraetes, they say that the rowers stood quite across the deck of the vessel when they rowed, as is done in wherries or barges at this present time. To lessen the difficulty, it is assumed that they must have ascended from the gunnel on the larboardside to the gunnel on the starboardside by steps, to suit the angle formed by the oar. But the same formidable objection occurs here that was urged against the preceding theory,

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* See Herodotus, Xenophon, Thucydides, *et alii.*

—the limited range of the oars from the rowers being placed so far from the scalmi. Moreover, half the number of oars could not be placed on the sides of this vessel that the old method gave, as the figure will show. (See Fig. 7 and 8.)

From the section and drawing, it is evident that this theory is as unlikely to be the true one as any of the others. The sacrifice of power, according to this hypothesis, is enormous. As each oar must thus work as it were isolated, it requires three times the space it would do were they all working in two distinct lines, one on each side, as in the usual mode, when each oar, as it were, occupies the space when pushed forward, which the immediate oar before it occupied when they were at rest; thus all, as it were, requiring only a single space equally divided, one-half at the extreme end, the other half at the beginning, while in this mode, each oar requires as much space as the whole range. But it is unnecessary to dwell longer upon this theory. The following extract from Athenæus, lib. v. chap. 37, where he gives the account of Ptolomy's galley of forty banks, is at once fatal to the supposition, that galleys had no more than one bank of oars, "πηδάλια δ' εἶχε τέτταρά, τριακονταπήχη· κώπας δὲ θρανιτικὰς ὀκτὼ καὶ τριάκοντα πηχῶν τὰς μεγίστας, αἳ, διὰ τὸ μόλυβδον ἔχειν ἐν τοῖς ἐγχειριδίοις, καὶ γεγονέναι λίαν εἴσω βαρεῖαι κατὰ τὴν ζύγωσιν εὐήρεις ὑπῆρχον ἐπὶ τῆς χρείας."—"It had four rudders, thirty cubits long; the largest oars

Plate IV.

Fig. 7.

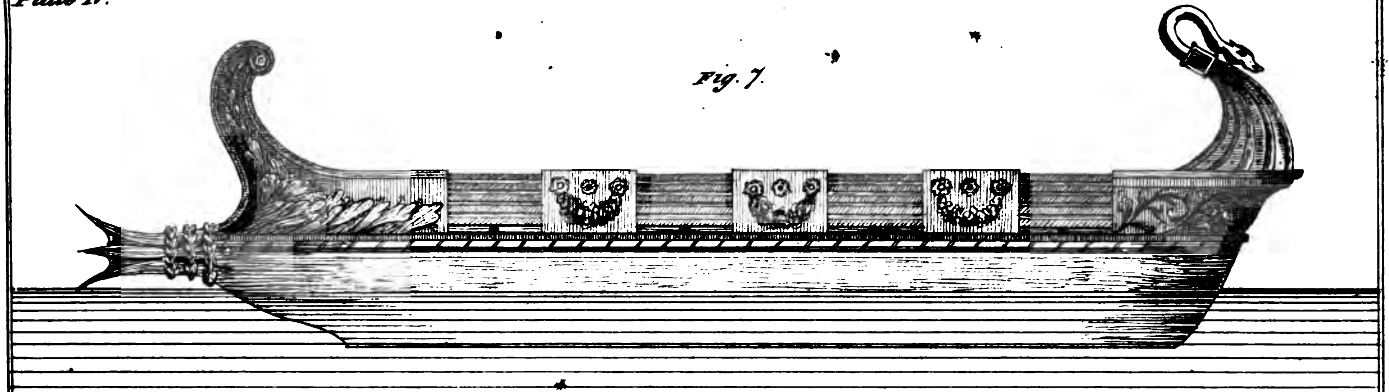

Fig. 8.

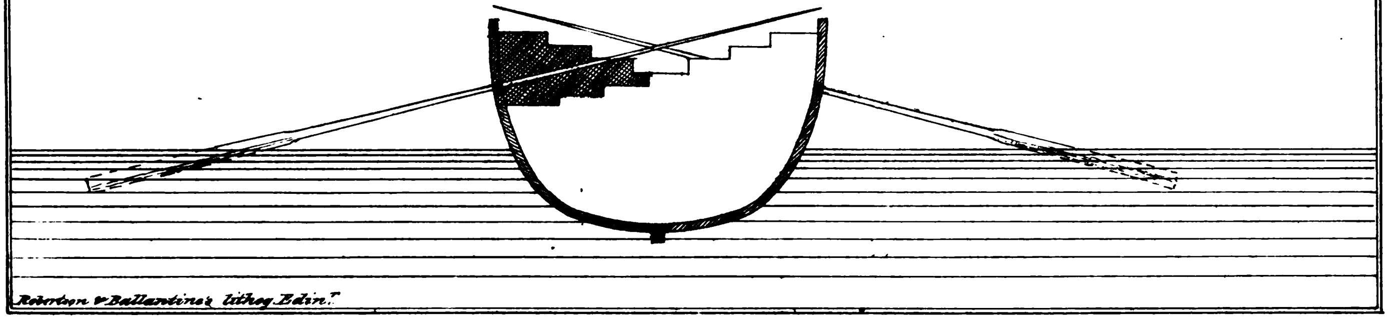

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Plate IV.

Fig. 7.

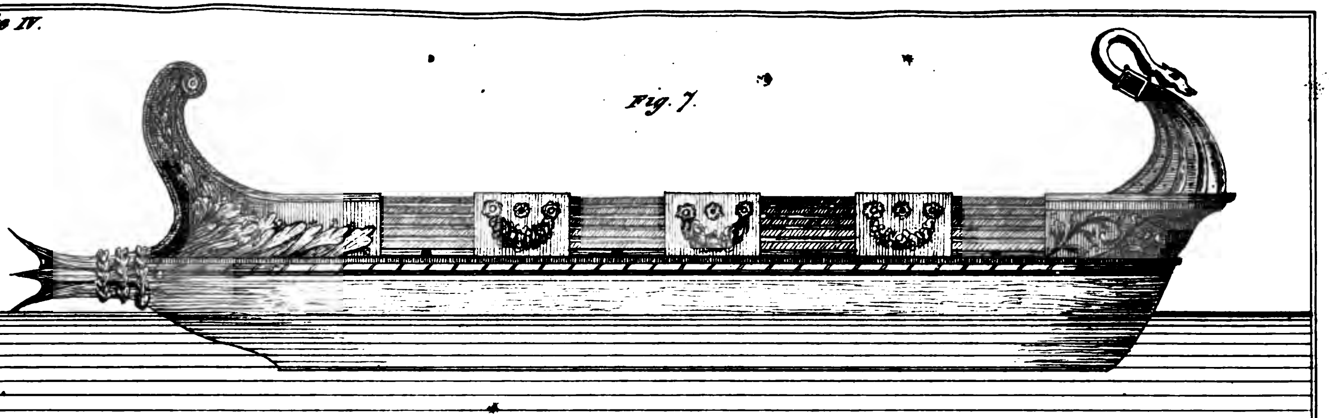

Fig. 8.

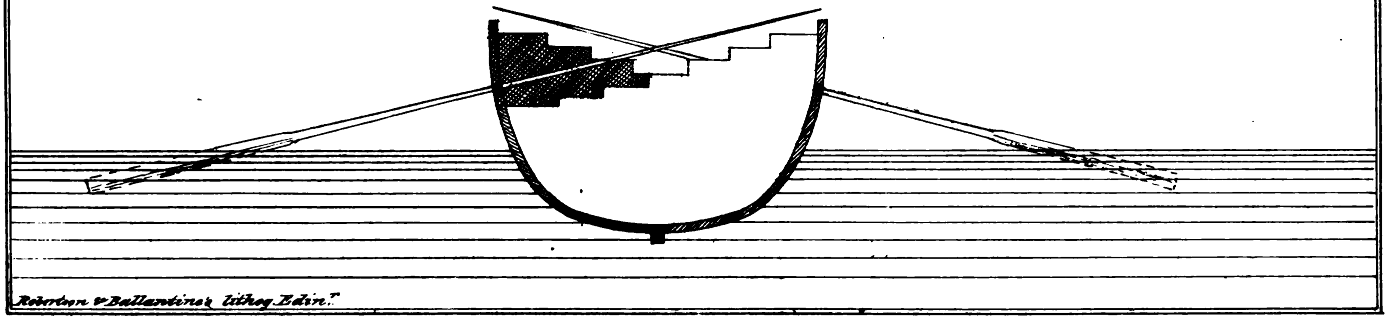

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Plate IV.

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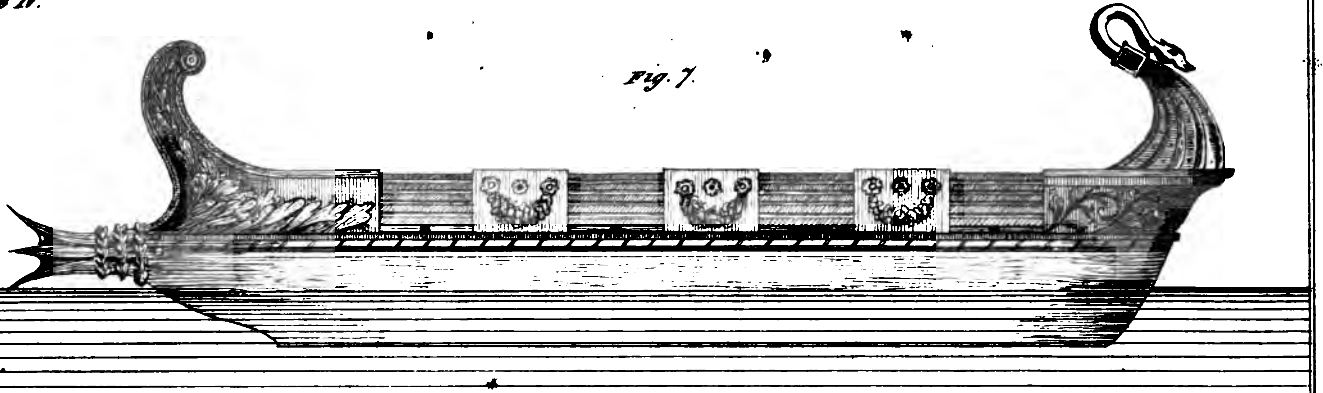
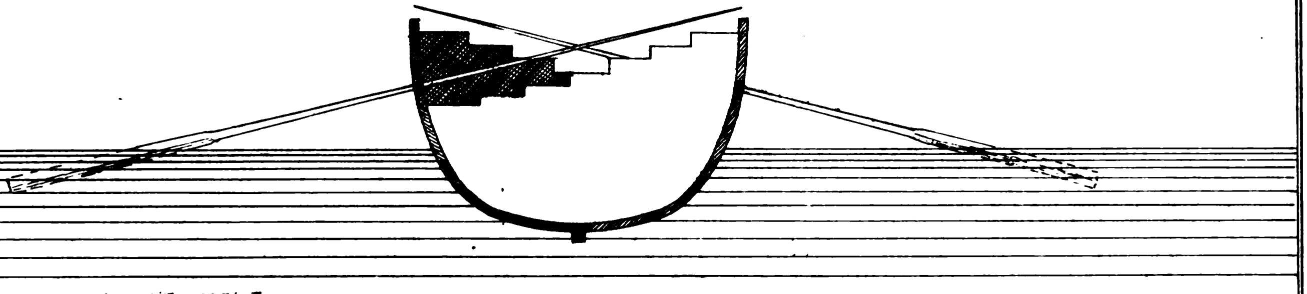


Fig. 8.



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of the highest order (or rank) were thirty-eight cubits long, which had lead in their handles, and were very heavy within the ship, according to the law of gravity, and the oars were more easily handled." This passage clearly implies, that only the longest oars, those of the highest rank, had lead in their handles; and the circumstance would not have been so expressly mentioned had there not been others that did not require this aid.

I now come to the fifth theory which has been formed on this subject. It is that maintained by Vossius in his treatise on the Trireme and Liburnicæ,* and by M. Le Roy.† These authors appear to have conceived that the oars were placed one over the other; but, aware of the untenableness of this opinion, on account of the impossibility of reconciling it to the laws of mechanism, *they* have given the seats of the rowers an oblique ascent. This goes but a short way to remove the difficulty. Vossius, by crowding the rowers, has gone the length of seven seats in his plan, placing the seventh oar on the catastroma. Le Roy, giving them more room, has gone only the length of five. Still attempting to reconcile their theory *to the* number of benches mentioned in the ancient authors, they have attempted to do this by the number of rowers in a bank, not by the number of banks of oars,—thus showing how the most vigorous minds, even when on the verge of arriving at their object, may be misled by being too closely wedded to a preconceived theory. Vossius gives the following diagram to illustrate his opinion.

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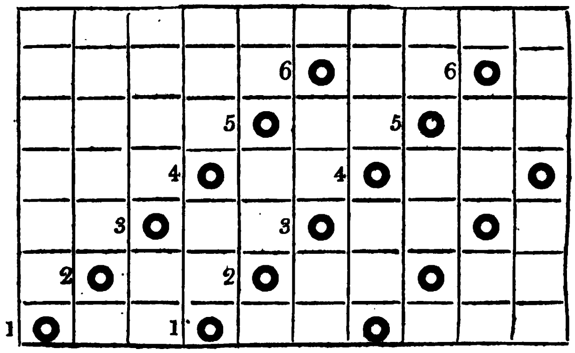
* Theusarus Antiq. de Rom. Gronovius, tom xii. p. 710.

† Sur la Marine des Anciens, in the Mémoires de l'Academie des Inscriptions, tom. xxxviii. p. 542.



In this view Potter coincides, and appears to have copied it in his Antiquities of Greece, vol. ii. p. 124, where he represents a Quinquireme, but allows only one rower to an oar. In this arrangement of the oars I entirely coincide, only not elevating the first three seats so much. Le Roy elevates his seats even more. The other diagram, copied from Vossius, shows how he makes out the larger galleys up to the forty ranks of oars, or rather rowers, according to his theory. I have drawn it horizontal as he has done; but it is

Plate V.

Fig. 9.

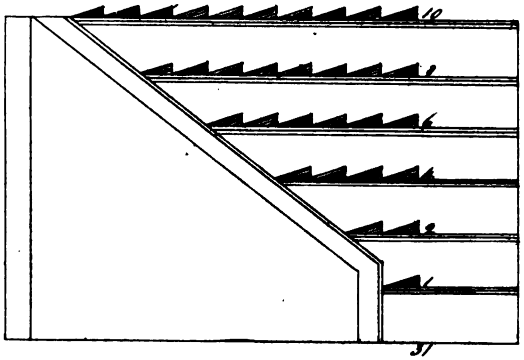


Fig. 10.

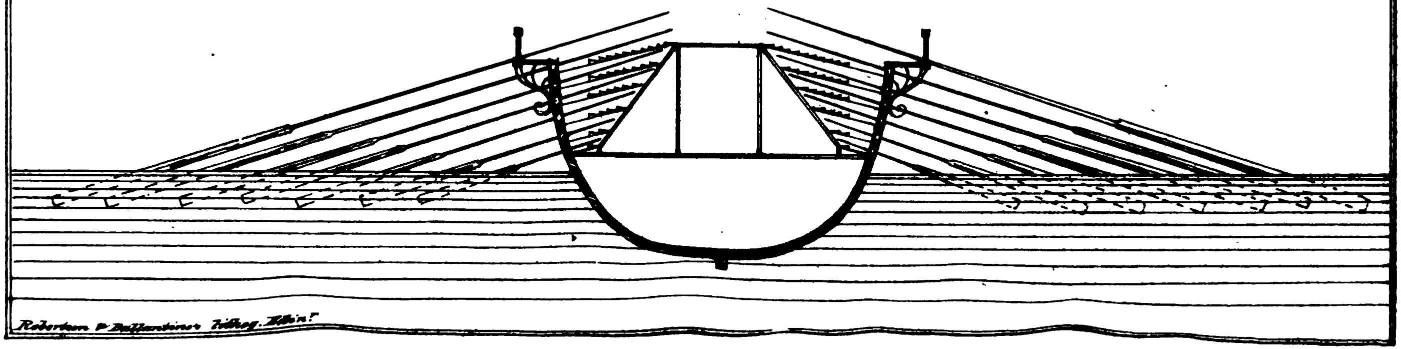


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Plate VI.

Fig. 11.

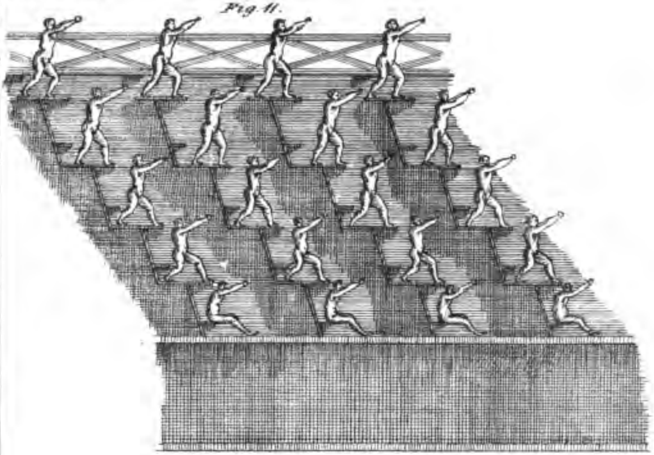

Fig. 12.

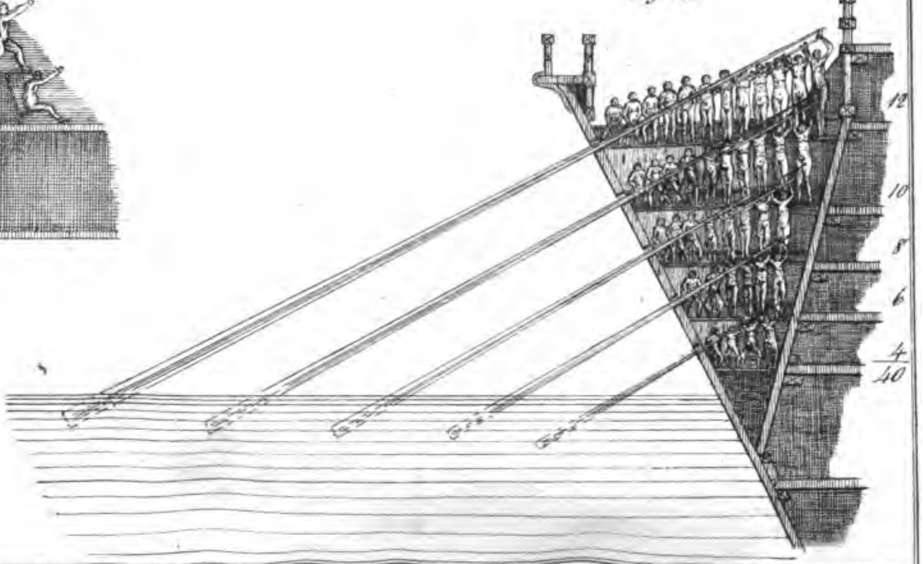

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Plate VI.

Fig. 11.

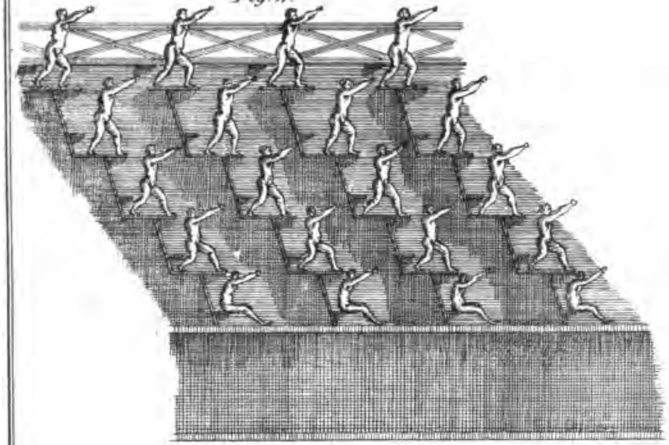
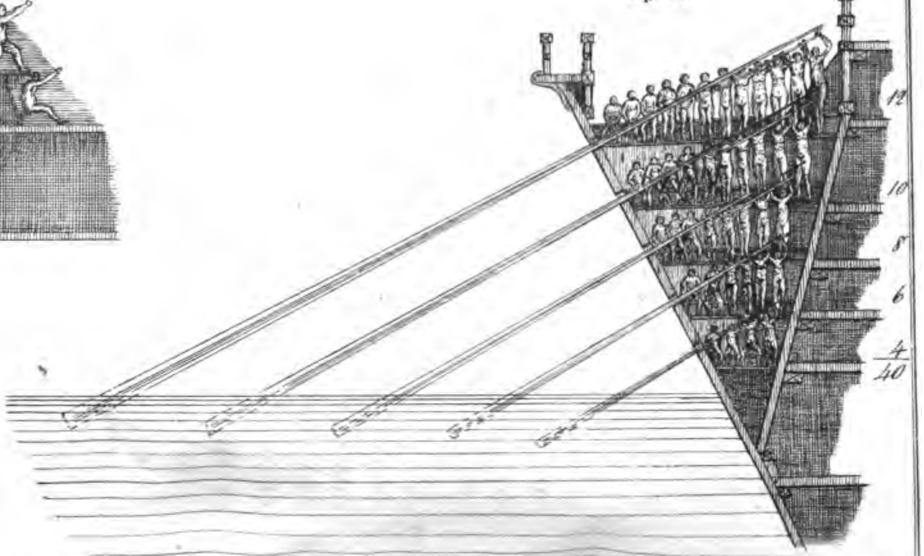


Fig. 12.



Robertson & Ballantines lithog. Edinr.

placed oblique from the water to the centre of the galley. The wedge-like seats being the level upon which the rowers sit, the beams are placed to answer the rake of the oars, as will be seen in the full section annexed. (See Figs. 9 and 10.)

With regard to the seventh oar, he observes, "let us return to the oars of the upper rowers, whose scalmi were not higher, as we have said, than the scalmi of the upper Zugitæ. For the Thranitæ sat upon the catastroma, not above, but rather at the side of the upper Zugitæ," and so on; —thus supporting, against his better judgment, a favourite opinion, for the catastroma was occupied by the soldiers, as expressly mentioned by Thucydides, στρατιωται διαπασης ειχον Καταστρωματα, the soldiers occupy the catastroma throughout.

Let us now see what Le Roy makes of the larger galleys. As his opinions are almost formed on those of Isaac Vossius, his representations of them in the engravings affixed to the letter-press will be sufficient to show in what points they differ. (See Figs. 11 and 12.)

From these representations it is evident, that the two opinions of Vossius and Le Roy are alike; that the rowers could not have kept up their exertions for any length of time, especially those whom they place at the longest oars. Besides, it is extremely improbable that the ancients would have designated their vessels by the number of rowers upon a

Plate VI.

Fig. 11.

Robertson & Ball.

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Robertson & Ba

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whole bank, in place of the number of banks in the vessel, for we often read of them not being fully manned, which would, according to this theory, have altered their rank at once from a greater to a smaller, making no difference on the number of oars. It often occurs in modern warfare that a ship is under-manned, yet it does not alter her rate. Neither did it with the ancients. Vossius and Le Roy offer the same solution as to all the classes.

I shall now close the account of the different theories proposed upon this subject, with that of General Melvill, which is the last that has been offered to the public. It is the same as that of Vossius and Le Roy, with this difference, he allows only one rower to each oar, and carries out a gallery from the side of the vessel at an angle of forty-five for the rowers and the scalmi,—an arrangement not so good as the two last, as it must have rendered the galley too crank, and difficult to trim.

I am under the necessity of being more circumstantial in the details of this arrangement. The learned Mr William Mitford, in his History of Greece, vol. ii., p. 194, in an appendix to chapter viii., says, "The most satisfactory conjectures that I have met with by far are those of General Melvill." Gillies also, in his *History of Greece*, is of the same opinion. I shall quote the General's own words as given in Pownal's *Treatise on the Study of Antiquities*, Appendix No. iii. pp. 236—240.

"He set himself to investigate the subject for confirmation of this opinion on fact, as he should find that fact to turn out in the description of sea-fights, and other naval transactions, as given by the ancient authors, particularly Polybius, Cæsar, Livy, and Florus. The issue of this research obliged him to relinquish his opinions which he had taken up upon authority as above. [The General had been of opinion that the galley was named from the number of men that pulled at one oar.] The descriptions, accounts, and facts, in these authors, evinced most evidently that these Triremes, Quadriremes, Quinquiremes; &c. were respectively so denominated, from the number of rows, banks, or tiers of oars, which they had on each side, and not from the number of men posted to each oar; on the contrary, it appeared that each oar was worked by one rower only.

"It occurred to him, that it must have been mainly for the sake of rapidity in their movements; and that, to obtain this purpose, the indispensable requisites were, that in the arrangement of the rowers within, each side ought to have been such, as to admit of the greatest number possible; that they should have been so placed as not to impede each other; that they should be enabled to my opinion, went far to show that the General's idea was well-founded." I shall not detain the reader for further particulars; if he wishes he may examine Pownal and Mitford, referred to.

From the above extracts, it is evident the General had never seen the essay of Vossius. The opinions of Le Roy were not before the public until the year 1777, when the thirty-eighth volume of the Memoirs of the Academy of Inscriptions and Belles Lettres was published, four years after the General's model was publicly shown.

As to the arrangement of the oars both parties agree, but as to the number of men to each bank of oars they totally differ in opinion. The General's projecting galleries, however, cannot be reconciled to the account left us in Athenæus of Ptolomy's vessel. The breadth of gallery for his Quinquireme was eight feet on each side, or sixteen feet on the galley.* Now, the whole breadth of the Tesseraconteres was thirty-eight cubits or fifty-seven feet; her length 280 cubits or 420 feet, thus making her breadth only twenty-one feet more than one-seventh of her length. The words are: "τὴν τεσσαρακοντήρη ναῦν κατεσκεύασεν ὁ Φιλοπάτωρ, τὸ μῆκος ἔκουσαν διακοσίων ὀγδοήκοντα πηκῶν, οκτὼ δὲ καὶ τριάκοντα ἀπὸ παρόδον ἐπὶ πάροδον ὕψος δὲ, ἕως ἀκροστολίου, τεσσαράκοντα ὀκτὼ πηχῶν. "The ship of forty orders of oars, constructed by Philopater, was in length 280 cubits, and her breadth was thirty-eight cubits from

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* Pownal, App. No. iii. p. 240.

(*παρόδον ἐπὶ πάροδον*) gangway to gangway, and the height of the poop was thirty-eight cubits."* I leave it to the reader to conceive how a gallery at an angle of 45° from the side, or any other angle, could have been constructed to correspond and have forty banks of oars, according to the General's plan.

Having given the General's description of his model, I now proceed to state, that he and all the others who have written upon the subject have mistaken the manner in which they conceive the banks to have been counted. This I hope to make evident. That he is wrong as to the number of oars he ascribes to his Quinquireme there is not a doubt. The crew of a Quinquireme, he allows, was 300 rowers† and 120 fighting men. By allowing only one man to an oar, he thus gives her 150 oars on a side. If such had been the case, galleys of 200 oars could not have been mentioned by ancient writers as those of very large dimensions. The General's galley had 150 on a side, the fifth of which is thirty; a Hexireme would have 180, a Septireme 210, or more, if he lengthens the vessel as he heightens her banks. The General, to prevent the seats of his rowers interrupting the ends of the oars in their movements, makes the seats only two feet in length from the edge of his gallery on which the scalmi was placed. This arrangement is evidently not a good one; for, in the first place, it reduces the power of his rowers by placing them too near the fulcrum of the oar. Secondly, the rower must have felt very insecure, and been liable to be pitched from his seat when either his galley struck or was stricken, when in action they drive their beaks against each other,—an accident that did at times occur even to those on the decks.* Callicratidas, the Lacedemonian general, was drowned by this accident. The General gives no account in what manner the banks of the larger galleys were arranged, neither does he show how either a Trireme or Quinquireme could be calculated by a fixed rate, as a few feet longer or shorter would either add to the number of rowers or diminish them,—a confusion that could not, and evidently did not exist, as they are always stated by the authors who speak of them as of a determinate size. He evidently held the same opinion as the earlier writers, that the banks of oars were counted from the water's edge to the gunnel of the galley, and that those of more than five banks were of little use in war.

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* Ath. lib. v. chap. 37.

† Polybius. lib. i. c. 26.

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* Xen. Hist. Graec. l. i. c. 6. Μετὰ δὲ ταῦτα ἐναυμάχησαν χρόνον πολὺν, πρῶτον μὲν ἀθρόαι, ἔπειτα δὲ διεσκεδασμέναι. ἐπεὶ δὲ Καλλικρατίδας τε, ἐμβαλούσης τῆς νεὼς, ἀποπεσὼν ἐς τὴν θάλατταν ἠφανίσθη. "And after these things they fought with ships a great while, and first in close bodies, then scattering, and when his ship made an attack, Callicratidas having fallen into the sea, disappeared.

SECTION III.

CONSTRUCTION OF THE WAR-GALLEY, AS ILLUSTRATED BY THE MODEL IN POSSESSION OF THE DIRECTORS OF THE EDINBURGH ACADEMY.

I NOW proceed to show the manner in which I conceive the ancients constructed their galleys of many banks; to do which it will be necessary, first, to inquire what was their object in departing from the older manner of building their ships, and the advantages they obtained from the new arrangement.

The first ship of any celebrity we read of among the Greeks, was the ship Argo, built by Jason, in which he brought the Golden Fleece from Colchis. She had fifty oars, twenty-five on a side. Now let us calculate her length by the number of her oars. By careful measurement I find that at present, in our smallest boats, the seats or thwarts are thirty inches apart when they pull four oars, and three feet when they pull more. In some the distance is greater, but we will apply the medium measure. Thus three feet between the thwarts, and one foot for the breadth of the seat, gives four feet, the least that can be allowed considering the size of the vessel. Four times twenty-five are 100 feet, not including the curvature of her bow and stern, which, at the least, must have been five feet more to each; thus making her at a low calculation 110 feet long; so that, by the same measurement, an ἑκατοντοροι must have been 210 feet long at the lowest computation—a most inconvenient length, which must have been long felt before Aneimocles found out the way to remedy it by constructing the Trireme, and, as hath been shown from Beauplan's Travels, accounts most satisfactorily for vessels called νῆες ἀμφοπρυμνοι, which we find mentioned having two prows and two rudders.

Another inconveniency which must have been severely felt as states advanced in civilization, and fitted out fleet to encounter fleet, was the want of footing for their soldiers. When we consider the ancient mode of naval warfare, and when at the onset, the stroke of the beak of the vessel failed of its effect, the men contended hand to hand as on shore. The open ship, with only seats for the rowers, or a small space at the stern, (if they had even this,) afforded but a scanty footing for either party, where an unlucky step might render the greatest strength and courage an easy conquest to the weakest who had the better fortune to have kept his footing.

That the first ships were built nearly of equal height from stem to stern, the straight line being very little if at all departed from except at the poop and prow, can scarce admit of a doubt; nor do I find in my reading that it has been called in question. To raise the prow and poop, and furnish the soldiers with a deck, that they might have a better field to fight upon, and a higher station from whence to throw their missile weapons, an object of the first importance in their mode of fighting, would therefore be a great improvement. The following interesting passage from Cæsar, (lib. iii. chap. xiii.) in which he describes the ships of the Veneti, a nation of Gaul in alliance with the Britons, the ships, he says, were built of oak, while those of the Romans were of fir; the sails were of leather, and they had chain-cables, " anchoras, profunibus ferreis catenis revinctæ ;" they were higher than the Roman Galleys; and Cæsar, aware of the disadvantage he laboured under, says, " neque propter altitudinem facile telum adjiciebatur."—" Nor could we throw our dart easily on account of their height." In the second place, had they added to the length of the ship, to obtain a deck at poop and prow, they must have added to the inconvenience already noticed.

If I am correct, the annexed figure, (Fig. 13,) nearly resembles what the ancient Monocrota must have been; and the object the ancients had in view will appear quite evident, viz. to obtain a sufficient height from whence to throw their darts, and allow footing for their soldiers. As the figure represents, there are ten seats for the rowers, so that she pulls twenty oars. The idea that appears to have struck the Erythreans will be seen in the next plate, where they, without adding to the length of the ship, found they could have the same number of oars in nearly one half of the length, by placing the oars obliquely. A poop and prow decked and raised to any height consistent with the safety of the vessel, seems to have naturally followed this improvement.

Thus, by adopting the oblique ascent, the distance between thwart and thwart is avoided, and the rowers of the first five oars are placed as high as they can sit, the one pushing his oar over the head of the rower before him without any hazard of interruption. The second five rowers forming the second bench are placed just so far behind as to allow the ends of their oars to play free of the benches before them; thus throwing the distance that was in the old manner between the thwarts into one space. As the first rower of the second bench can sit with room enough beneath the fourth seat of the first, the space for two oars is gained. That a rank or bench of oars never con-

Plate VII.

Fig. 13.

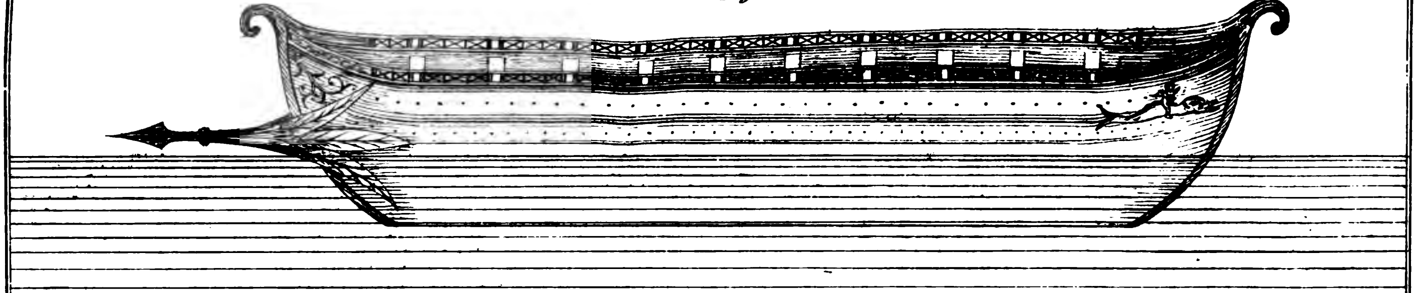
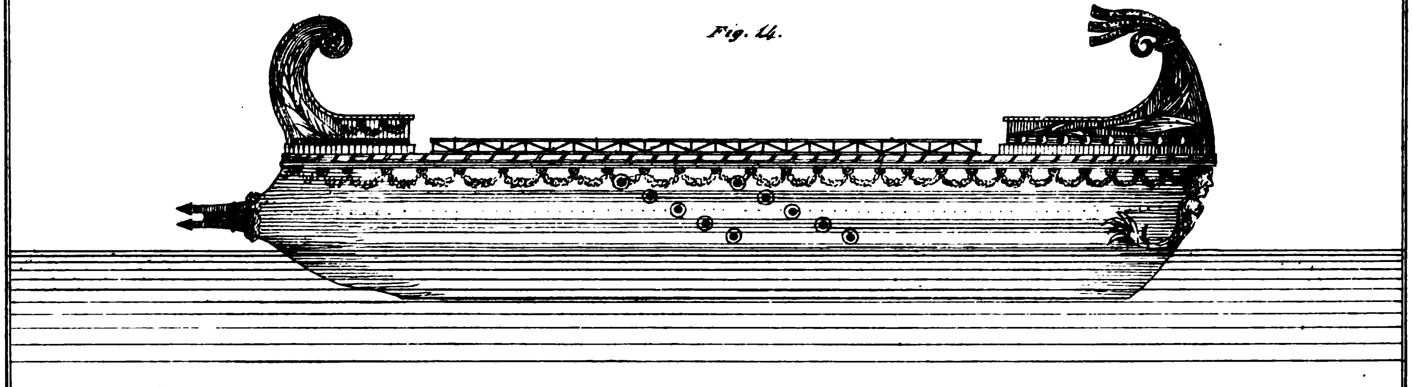


Fig. 14.



Robertson & Ballantine's Lithog. Edin.

Plate VII.

Fig. 13.

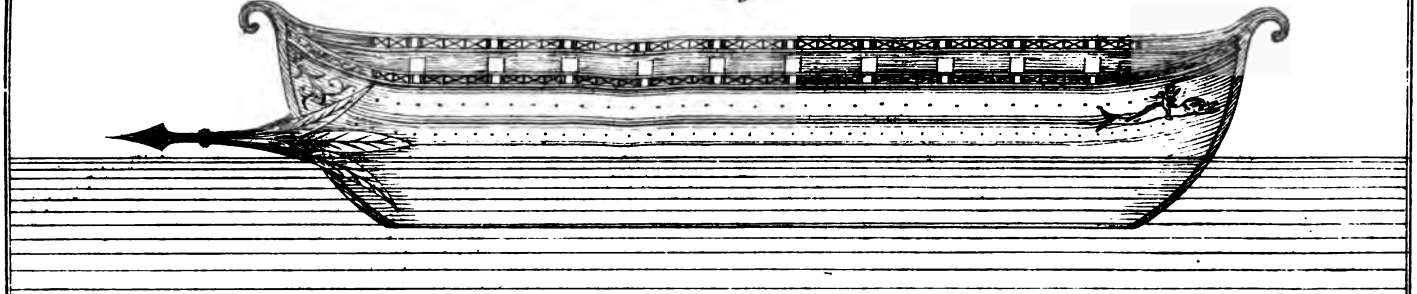
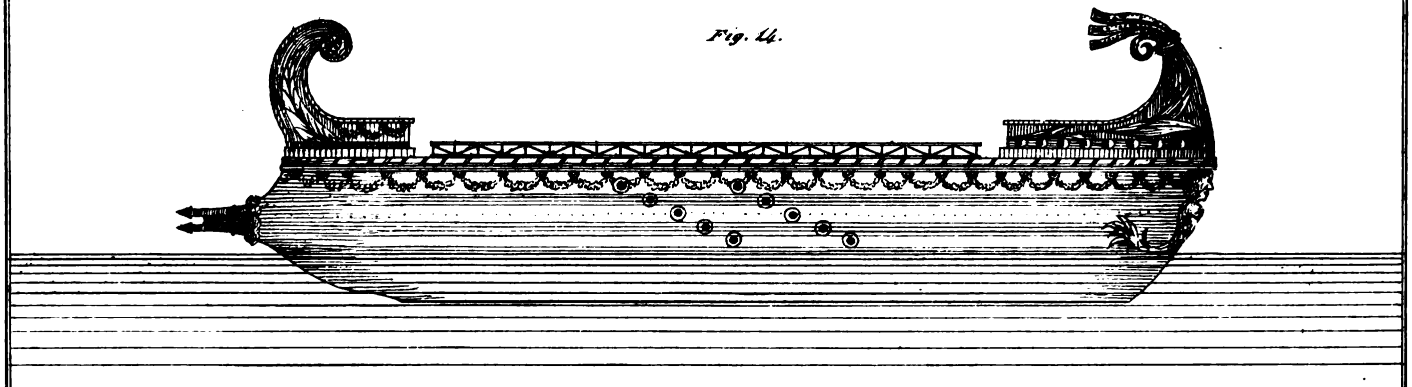


Fig. 14.



Robertson & Ballantine's lithog. Edinr.

tained more than five oars, I think can be proved, whatever the size of the galley was, whether a Bireme or Trireme, up to the galley of Philopater, which had forty banks, nine feet being the highest point from the water for the scalmi from which they could pull with effect. That the scalmi of Philopater's galley did not exceed this, is evident from Athenæus, lib. v. chap. 37, (as quoted in page 33.) The longest oar was thirty-eight cubits or fifty-seven feet; there could not be less than three feet from the water's edge to the lower edge of the oar-port, and eighteen inches for the width of it. That they were so wide, was necessary for the size of the oar, and we learn it also from a curious fact. Megabates, visiting the fleet, found a Grecian galley without its guard, and thus he punished the captain, Herodotus, (lib. v. chap. 33,) Διὰ θαλαμίης διελόντας τῆς νεός. The meaning evidently is, "he bound him to the lowest bench, with his head out of the oar-port."

This he could not have done had the oar-ports been less. Now, from the lower bench to the upper bench inside, five feet is sufficient for both man and oar. The benches being placed sloping from the lowest up to the fifth or highest, as is shown on the outside of the galley, Fig. 14, the outer edge of the upper oar-port would be four feet six inches from the upper edge of the under port, whose width is eighteen inches, so that nine feet is all that was required for the height of a bank's ascent. Adopting this idea, the difficulty of the subject is at once removed, and, as I have said before, when once this method of placing the oars was found out, expence or convenience were the only objects to be studied by the ancients, for nothing could be more easy than adding to the length of the galley according to the number of banks required, even up to one hundred, could such a large vessel have been easily navigated. That there were no oar-ports either in the prow or stern for a considerable distance towards the waist of the galley, is proved by the naval column erected to Duilius after his victory over the Carthaginians, still to be seen at Rome. It had its name from the beaks of ships with which it was adorned, Plate 8. Florus mentions this column, and says it was erected in honour of Duilius, with an inscription to perpetuate his fame. About the end of the sixteenth century it was dug up at Rome. A slight glance at the representation will serve to show, that not only the beak, but a considerable length of the prow is fixed upon the column, and there is no mark of any aperture for oars; thus showing that the galleys of the Carthaginians, and of the Romans, built after their model, had their rowers placed, not in lines from stem to stern, but in the middle of the galley, leaving a space in her quarters free from oars extending for a good way. The advantage of this was, it allowed their

Plate VIII.

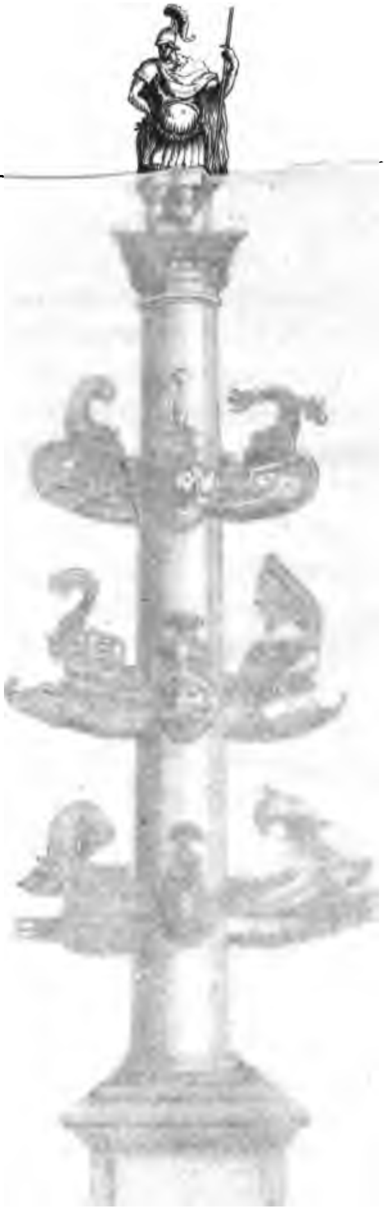


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Plate IX.

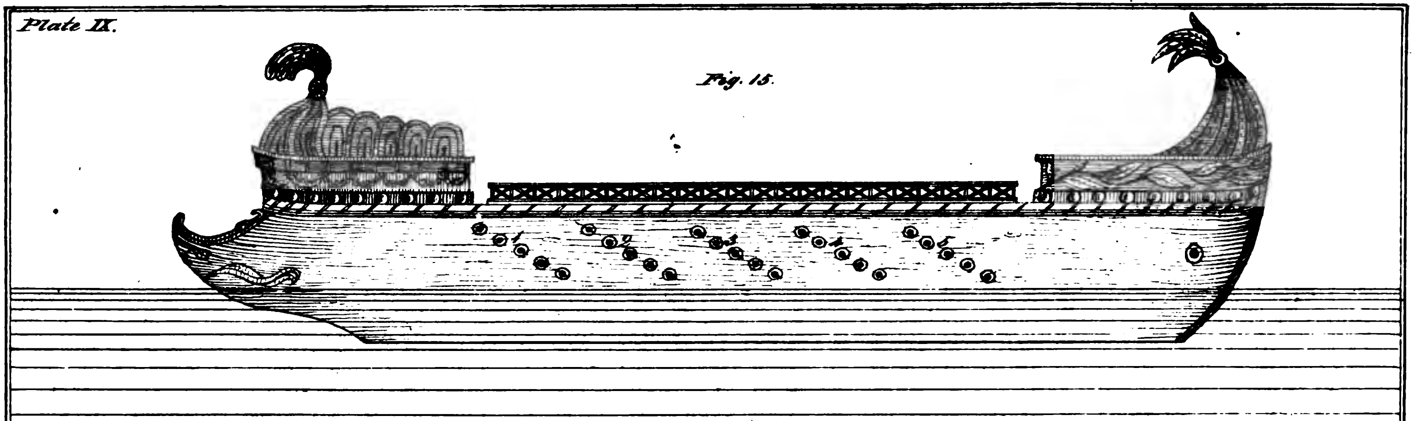
Fig. 15.

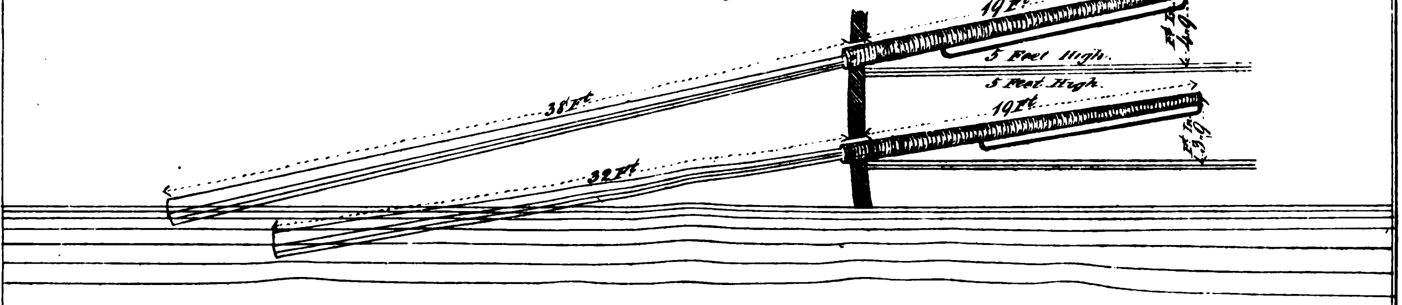
Fig. 16.

Robertson & Ballantine, Lithog. Edinr.

Scale of 5 10 15 20 Feet.

galleys to manœuvre and cross each other with less danger to the rowers. A Quinquireme on this model is represented in Fig. 15.

There being always a series of five oars, rising in an oblique line, which the ancients called a bank or rank of oars, the number of banks being counted from stem to stern, by this arrangement we find no difficulty in reconciling to the laws both of reason and mechanism, the various mention of them in Athenæus, Polybius, Livius, and Plutarch, &c. That the upper oar was only about nine feet from the water in Ptolomy's Tesseraconteres, I think cannot admit of a doubt. Vossius in his treatise (*de Liburnicis*) has demonstrated it to a certainty, and that it is near the highest point on which an oar can be placed to pull with effect, any one may satisfy himself by drawing two lines to the scale of proportion; for if placed higher, it dips too much into the water at one end, while at the other it rises to an inconvenient height, thus making it evident that there was not so great a disproportion between the highest and lowest oars as we are apt to conceive at the first view of the subject.

I have, in speaking of General Melvill's theory, assigned one reason why I think the galleys had more than one man to each oar. Suetonius says expressly that the Liburnicae of Caligula had ten men to each oar; that of Caius, according to Pliry, had five. Taking into consideration the loftier built galley of many banks, all seamen will at once allow that she must have been heavier to pull. That it was so we are assured was the reason of these vessels being laid aside, and we often read of their not being fully manned, as was the case with many of the ships of Pompey.* This, I conceive, meant, not that any of her oars were awanting on this account, but that her benches were not full, according to the complement for her rate. If this be allowed, which I think reasonable, every difficulty is removed, and this view of the subject is at once reconciled to the number of rowers allowed by the ancient authors to the different rates of the galley; and all becomes as distinct and well-defined as any subject that has been written of in modern times,—no ambiguity arising in the mind when a Trireme or Quinquireme is mentioned.

Mitford,† in his history of Greece, in more than one place, says that the crew of a Trireme, at the time of the invasion of Xerxes in the Greek fleet, was from 150 to 160 rowers, and forty heavy armed foot. The Persian Trireme, he says, had 200 rowers, and 30 Persians or Medes. I have shown that a modern galley pulling fifty oars has six rowers on a bench. Now, if I am correct, a Trireme pulled thirty oars; that is three banks, five oars in each, thus:

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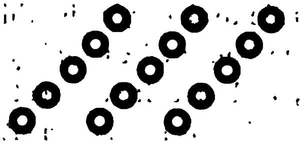
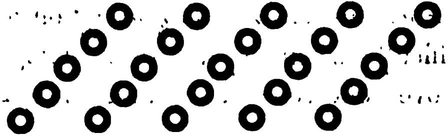
* Plutarch, vit. Pompey.

† Mit. Hist. Greece, Vol. ii.



Now, to a vessel of her bulk with elevated poop and stern, less than five men cannot be allowed to each seat. Thus there are twenty-five rowers in each bank, and six times twenty five make 150; the remaining ten are a small enough number for casualties, steering the vessel, and handing her sails when they are required. That the crew of the Grecian Trireme was 150 or 160, I have not a doubt; if the Persian Trireme had 200, she must have had six men to an oar, which is not improbable, the Asiatics being not so athletic as the Greeks. Six times thirty is 180, leaving twenty men for casualties, &c. The heavy armed foot varied according to circumstances, but the crew almost never varied. Polybius informs us, the crew of a Quinquireme was 300 rowers and 120 fighting-men.* Now, a Quinquireme having five banks, thus,



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[*] Polyb. l. i. c. 26. "Καὶ τὸ μεν σύμπαν ἦν στράτευμα ταύτης ναυτικῆς δυναμεως περὶ τετταρας καὶ δεκα μυριάδας· ὡσὰν εκάστης ἰδία νεὼς

pulled fifty oars, or twenty-five on a side; the same number as the modern galley already described, having six men to an oar, as by this arrangement, adding to the banks of the galley did not add to her height, and not in a great degree to her length, seven feet being sufficient for a bank, I think the addition of one man to an oar was all she could require. Six times five is thirty, and ten times thirty is 300. Both of these are remarkable coincidences, and tally better with the authors than any solution that has yet been given.

I shall now show how remarkably it agrees with Athenæus; thus taking in the whole range, and applying to all, a thing that it never could do were it not very near the truth. The Tesseraconteres, having forty banks, five oars to a bench, makes her have 200 oars of a side, or 400 in all. Considering her size, she could not have had less than ten men to each oar. We find from Suetonius that the Liburnicae of Caligula had the same number; now 400 oars, with ten men to each, gives 4000; the number mentioned by Athenæus, lib. v, chap. 37. "Γενομένης δὲ ἀναπείρας, ἐδέξατο ἐρέτας πλείους τῶν τετρακισχιλίων· εἰς δὲ τὰς ὑπηρεσίας, τετρακοσίους· εἰς δέ το κατάστρωμα ἐπιβάτας τρισχιλίους, αποδέοντας ἑκατὸν καὶ πεντήκοντα· "on account of the difficulty when she was to be navigated, she had above 4000 rowers, and there were for naval

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λαμβανουσης ἐρέτας μὲν τριακοσίους ἐπιβάτας δὲ ἑκατον ἔικοσι "And there was in the whole fleet 140,000, each ship containing 300 rowers, and 120 soldiers."

services about 400 seamen on her catastroma, 3000 passengers (or persons unconnected with the navigation, επιβάτας is rendered soldiers by the scholiasts, which I think right,) with the reduction of 150." That there was length of oar both for the rowers and to navigate the vessel, will appear quite evident from the draught, Fig. 16; that both the higher and lower oars had the same number of rowers, there can be no doubt. It has been already shown that, being in equilibrio, the effort required was the same; besides the difference of length could not exceed eight feet between the highest and lowest rank.

The length of the vessel was 280 cubits, or 420 feet. Now, allowing her to have seven feet between bench and bench, seven times forty is 280 feet, which the rowers occupied in the waist of the galley, leaving seventy feet at the prow, and seventy at the stern, for accommodation for the officers and stores, to be fitted up as the architect might choose. The breadth was thirty-eight cubits, or fifty-seven feet; her oars came within her sides nineteen feet, one-third of their length: this is the proportion invariably used in the Mediterranean galleys, as found to be the best. Twice twenty-one feet is forty-two, leaving fifteen feet between the rowers on each side for the multitude of men who administered to the necessities of the crew, &c. without any encroachment upon the space in the poop or prow. The section of her waist will show this best. (Fig. 17.)

The passage which Marisotus quotes from the Emperor Leo is now quite plain: "Every ship of war *must be of its due length*, (*i. e.* according to the number of banks, no mention is made as to height,) having two ranks of oars, the one higher, the other lower." Now, by this arrangement, there can be but two lines of oars, the one above the other.

Led by the account of the classing of the rowers in the modern galley, and the fixed laws of motion and matter, I may appear to the classic reader to have taken too much liberty in departing from the arrangement of the rowers, as adopted by all the moderns who have written upon this subject. I readily agree that Athenæus calls the longest oar the ϑρανιτακὸς, and other authors use the same word for the same purpose. The middle oars were called ζυγὰ, the lowest oars ϑαλαμος. In my opinion, the same terms apply to the oars as were applied to the rowers, highest, middle, and lowest. Let us see the literal meaning of ϑράνοι; θρηνος and θρονος are derived from θραν, which is gone into disuse. Hence θρανιζειν and θρανιται, the hissing letter being thrown out in the usual way. Hence, we have θρανιται, and likewise θρανιστρον, from which comes *transtrum*, a higher seat, (for the Greek word signifies a throne.) Now, as the Thranites sat at the

Plate X.

Fig. 17.

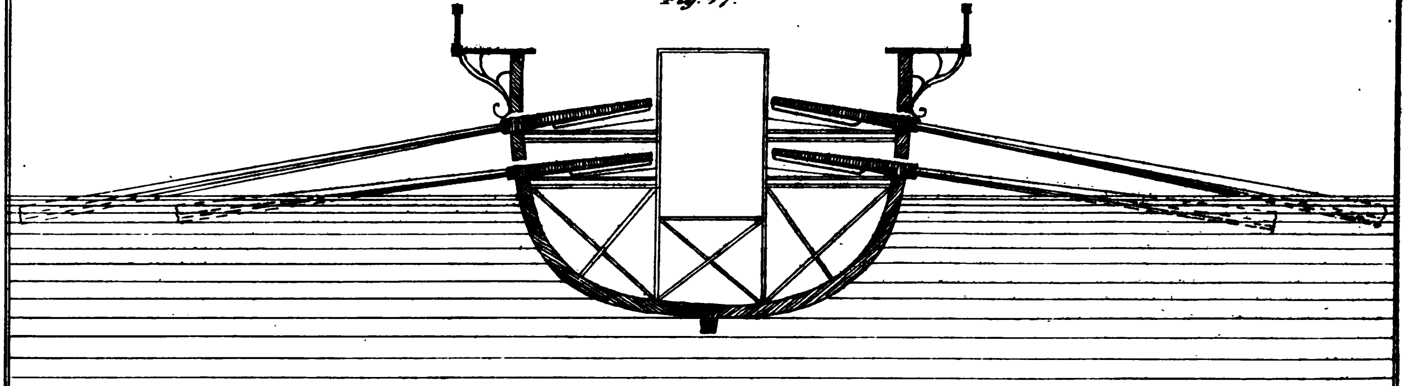
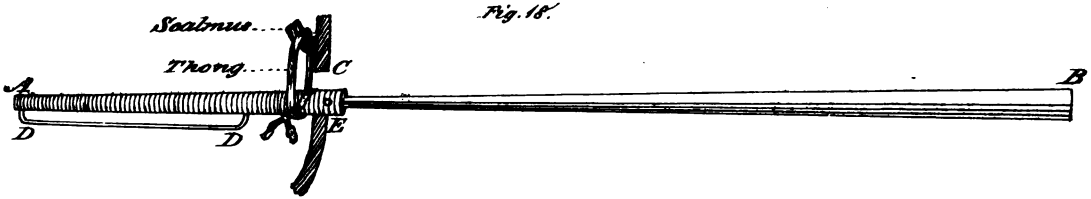


Fig. 18.



Robertson & Ballantine's lithog. Edinr.

highest point, (*i. e.* pulled at the extreme end of the oar,) were, with great propriety, named θρανοι; and by a common transition in language, both men and oars obtained the same name from their relative position in the ship, the body described; and it was not the oar the men pulled that gave their title, but their place at the oar; and the oar's position in the bank also gave its name to it with equal propriety. I am of this opinion, perhaps alone: Scheffer has bestowed an immense deal of learning to prove that each oar was rowed by only one man, and the banks were one over the other.

I have already endeavoured to explain the ικρια νηος of Homer in the literal meaning, *i. e.* the seats or thwarts; the decks were called by the ancient Greeks επηγκηνιδες, by the modern Καλακαθμα because they were a footing or support for the soldiers and passengers. In a similar way, that part of the catastroma on which the inferior soldiers stood was called the πελμα. That the επηγκηνιδες or deck was within the galley over the belly of the ship, between the seats of the rowers, there can be little doubt, for the Καλαστρωμα or gallery was always without, the rowers, as we find the modern galleys have it, calling it the bande, the soldiers occupying it in the same manner as in the ancient. See Athenæus. Thucydides says expressly, "στραῖοι σπιυβαπαδης ειχον Καλαστρωματα." "The soldiers occupied the catastroma on the further side." Vossius is correct in his description of the catastroma.*

The justness of this view of the subject will be more evident, if we for a moment take into consideration the climate of Greece, where, during the summer months, the only time in which the galleys were employed, to have covered up the rowers with decks would have been fatal to them, as human beings could not subsist in the situation in which they must have been placed. The great heat of a covered vessel in summer is known to all who have been at sea, even in our latitudes; what would it be then in a galley with 150 or 300 rowers in violent action? The idea cannot stand a moment's investigation.

That the Κατα φρακτοι of the Greeks, and tectae of the Romans, had only the belly of the galley covered, and not the whole from catastroma to catastroma is plain; we have it in the coursier of the modern galley. The uncovered, called by the Greeks αφρακτοι, by the Romans apertae, had the *transtra* or seats of the rowers from side to side across the galley, these last being of a less size than the covered galley. This, in my opinion, goes far to show that there were more than one rower at each oar, the breadth occupied by them athwart the galley not allowing room for the Καταστρωμα or deck. Had there been only one rower to each oar, the galley must have been of a narrowness quite inconceivable to her length, not to allow of a deck. It is a fact known to seamen, that a very narrow vessel is always crank, or apt to overset, and difficult to trim—a quality that would render a war-vessel where they fought hand to hand, and the crew must crowd to the side when the enemy attack to defend her, or to attack in turn, quite useless.

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* Thes. Antiq. Grenov. tom. xii. p. 710.

It only remains to attempt an explanation of the oars employed by the ancients in rowing their galleys. As they are not described by any of the ancient authors, I have thought it best to apply for information to the moderns, and have followed Isaac Vossius in his description of the oars in use in the Mediterranean galleys of his time. There was, in all probability, very little alteration in their construction from their first use until the present time. It being simple in itself, and only adapted to one object, its improvement must have been rapid, and when found quite efficient, there was no inducement to alter it. (See Fig. 18.) Thus an oar of thirty-six feet long A to B, has from A to C a space of eleven feet within the galley; it is hung upon the scalmi by the thong at C; it is here extremely thick, nine inches in diameter, and as the hand could not grasp it, there is a handle fixed upon it, DD. It extends within to about three feet of the scalmi thong. Were the rowers nearer, a great deal of their power would be lost by being placed too near the fulcrum of the lever. From C to B is the length of twenty-five feet; this is the blade of the oar, and extends out of the side down to the water; it is nine inches broad at B, and tapers up to C, where it is inserted into the handle, and kept in its place by the pin E; by pulling out this pin, the rowers within the galley could at any time allow the blade of the oar to be held close in by the side of the ship, or in any other position through the oar-port; and, the handle remaining suspended from the scalmi, it could be at once again inserted, and their labour resumed. This division of the oar gave it many advantages which it would not have possessed in one piece. The ancients, we are informed, used to cover the broad part of the blade of the oar at the point with plates of brass to protect it from injury.

To conclude, if I have been successful in the preceding pages, I have made it plain that the ancient Polycrota had not more than five oars, ascending in an oblique line, which the ancient authors called a bank or rank of oars; that the vessel had her name from the number of these extending from the prow to the poop; that each galley, according to her bulk, had a proportionate number of rowers placed at each oar, classed according to the place he pulled of that oar, and not the place in the bank; that the first ships were entirely uncovered ; and that the object the ancients had in view was to obtain an elevated deck at prow and poop, from whence to annoy the enemy.

That my opinion may be the better understood, I have given a correct drawing of the model of the Hexireme built by me for the Directors of the Edinburgh Academy.

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